

NASA Contractor Report 3200

NASA  
CR  
3200-  
pt.1  
c.1

LOAN COPY RE  
AFWL TECHNICAL  
KIRTLAND AFB

0091856



# Rotary Balance Data for a Typical Single-Engine General Aviation Design for an Angle-of-Attack Range of $8^{\circ}$ to $90^{\circ}$

I - Low-Wing Model C

William J. Mulcay and Robert A. Rose

CONTRACT NAS1-14849  
OCTOBER 1980

**NASA**



0061866

# NASA Contractor Report 3200

## Rotary Balance Data for a Typical Single-Engine General Aviation Design for an Angle-of-Attack Range of $8^\circ$ to $90^\circ$

I - Low-Wing Model C

William J. Mulcay and Robert A. Rose  
*Bihrlle Applied Research, Inc.*  
*Jericho, New York*

Prepared for  
Langley Research Center  
under Contract NAS1-14849



National Aeronautics  
and Space Administration

Scientific and Technical  
Information Branch

1980



## SUMMARY

Aerodynamic characteristics obtained in a helical flow environment utilizing a rotary balance located in the Langley spin tunnel are presented in plotted form for a 1/6-scale, single-engine, low-wing, general aviation model (model C). The configurations tested included the basic airplane and control deflections, wing leading edge and fuselage modification devices, tail designs and airplane components. Data are presented without analysis for an angle-of-attack range of  $8^{\circ}$  to  $90^{\circ}$  and clockwise and counter clockwise rotations covering an  $\frac{\Omega b}{2V}$  range from 0 to .9.

## INTRODUCTION

The NASA Langley Research Center has a broad general aviation stall/spin research program underway which includes spin-tunnel and free-flight radio control model tests, as well as full-scale flight tests for a number of configurations typical of light, general aviation airplanes. To support this effort, rotary balance wind tunnel force tests covering these same configurations will be conducted to establish a data base for analysis of model and full-scale flight results, and to develop design charts for desirable stall/spin characteristics.

A 1/6-scale, single-engine, general aviation model, referred to as model C, having a low-wing location, was tested in a helical flow environment utilizing a rotary balance located in the Langley spin tunnel. This report presents the data obtained for the basic configuration and control settings, various wing leading-edge and fuselage modifications, tail designs and airplane components. Data for model C having a high-wing location are presented in reference 1.

## SYMBOLS

The units for physical quantities used herein are presented in the International System of Units (SI) and U.S. Customary Units. The measurements were made in the U.S. Customary Units; equivalent dimensions were determined by using the conversion factors given in reference 2.

$b$	wing span, m (ft)
$\bar{c}$	mean aerodynamic chord, cm (in.)
$C_N$	normal-force coefficient, $\frac{\text{Normal force}}{qS}$
$C_A$	axial-force coefficient, $\frac{\text{Axial force}}{qS}$
$C_Y$	side-force coefficient, $\frac{\text{Side force}}{qS}$
$C_\ell$	rolling-moment coefficient, $\frac{\text{Rolling moment}}{qSb}$
$C_m$	pitching-moment coefficient, $\frac{\text{Pitching moment}}{qS\bar{c}}$
$C_n$	yawing-moment coefficient, $\frac{\text{Yawing moment}}{qSb}$
$q$	free-stream dynamic pressure, $N/m^2$ (lb/ft <sup>2</sup> )
$S$	wing area, m <sup>2</sup> (ft <sup>2</sup> )
$V$	free-stream velocity, m/sec (ft/sec)
$\alpha$	angle of attack, deg
$\beta$	angle of sideslip, deg
$\Omega$	angular velocity about spin axis, rad/sec
$\frac{\Omega b}{2V}$	spin coefficient, positive for clockwise spin
$\delta_a$	aileron deflection, positive when right aileron is down ( $\delta_{a_{\text{right}}} - \delta_{a_{\text{left}}}$ )/2, deg
$\delta_e$	all movable horizontal tail deflection, positive when trailing edge is down, deg
$\delta_r$	rudder deflection, positive when trailing edge is to left, deg

#### Abbreviations:

cg    center of gravity  
LE    leading edge  
SR    spin radius  
TE    trailing edge

#### TEST EQUIPMENT

A rotary balance measures the forces and moments acting on an airplane while subjected to rotational flow conditions; the background for this apparatus is discussed in reference 3. A photograph and sketch of the rotary balance apparatus installed in the Langley spin tunnel are shown in figures 1 and 2, respectively. The rotating portion of the balance system, mounted on a horizontal supporting boom which is hinged at the wall, is moved from the wall to the center of the tunnel by cables. The rotary arm of the balance system, which rotates about a vertical axis, is attached to the outer end of the horizontal supporting boom and is driven by a drive shaft through couplings and gears.

A test model is mounted on a strain gauge balance which is affixed to the bottom of the rotary balance apparatus. Controls located outside the tunnel are used to activate motors on the rig which position the model to the desired attitude. The angle-of-attack range of the rig is 8 to 90 degrees and the sideslip angle range is  $\pm 15$  degrees. The spin radius and the lateral displacement motors allow the operator to position the moment center of the balance on the spin axis or at a specific distance from the spin axis. This is done for each combination of angle of attack and sideslip angle. The general practice is to mount the moment center of the balance at the cg location about which the aerodynamic moments are desired. Electrical current from the balance, and to the motors on the rig, is conducted through

the slip rings located at the rig head. Examples of how the rig is positioned for different angle of attack and sideslip angle are shown in figures 2a and 2b, respectively.

The model can be rotated up to 90 rpm in either direction. By using different rotational speeds and a specific airflow in the tunnel, the motions of a steady spinning airplane can be simulated. The aerodynamic forces and moments can then be measured for values of  $\frac{\Omega b}{2V}$ , including the case of  $\frac{\Omega b}{2V} = 0$ , where static aerodynamic forces and moments can be obtained.

A NASA six-component strain gauge balance is mounted inside the model and measures the normal, lateral and longitudinal forces and the yawing, rolling and pitching moments acting about the model body axis. The interactions that exist between the six components are available from balance calibration tests and are accounted for after the balance voltages are converted to forces and moments.

The data acquisition, reduction and presentation system for the rotary balance system is composed of a 12-channel scanner/voltmeter, a mini-computer and a plotter. With this equipment, on-line digital print-out and/or graphical plots of data are possible.

#### TEST PROCEDURES

Rotary aerodynamic data are obtained in two steps. The first step is to record the inertial forces and moments (tares) acting on the model at different attitudes and rotational speeds. To accomplish this, a covered bird-cage like structure is mounted to the upper rig which encloses the model without touching it. In this manner, the air immediately surrounding the model is rotated with it. As the rig is rotated at the desired attitude and rate, the inertial forces and moments generated by the model are measured and stored on magnetic tape for later use.

The second step in the data-gathering process is to measure aerodynamic and inertial forces at different attitudes and rotational speeds for a selected tunnel velocity with, of course, the cage structure removed. The tares are subtracted from these values, and the remaining aerodynamic forces and moments are then converted to coefficient form and stored on magnetic tape.

#### MODEL

A 1/6-scale low-wing, single engine, light general aviation model was constructed of fiberglass-epoxy, wood and aluminum. A three-view drawing of this model is shown in figure 3, dimensional characteristics of the basic model are listed in Table I, and a photograph of the model installed on the rotary balance located in the Langley spin tunnel is presented in figure 1.

The various airplane components were removable for component build-up tests, the testing of wing leading edge and fuselage modification devices and tail configurations. The three tail configurations tested involved different vertical and horizontal locations of the horizontal tail as shown in figure 4. The wing leading edge modifications include full-span leading edge droops of moderate and large nose radius and an outboard drooped section of large nose radius (figures 5 and 6). The fuselage modifications tested include a cowl-strake and tail-fillet combination and with addition of either a ventral fin or emergency spin chute installation (figure 7). Also tested were a sharp-edged fuselage bottom and a dorsal fin off configuration (figures 8 and 9).

The model control surfaces could be set at any position prior to the test. The maximum deflections for the control surfaces were:

Rudder, deg	25 right, 25 left
All movable horizontal tail, deg	15 up, 2 down
Aileron, deg	20 up, 10 down

## TEST CONDITIONS

The tests were conducted in the spin tunnel at an airstream velocity of 7.62 m/sec (25ft/sec) which corresponds to a Reynolds number of approximately 119,000 based on model wing chord. Unless noted otherwise in Table II, all the configurations were tested through an angle-of-attack range of 8 to 90° at a zero sideslip angle, with the spin axis passing through the full-scale airplane cg location for angles of attack above 30°. For angles of attack below 35°, the spin axis was set 182.9 cm (72 in.) forward of the cg location. Consequently, data was obtained for both 0 and 182.9 cm (72 in.) spin radius at angles of attack of 30 and 35°. For each angle of attack, data were obtained for nominal  $\frac{\Omega b}{2V}$  values of .1, .2, .3, .4, .5, .6, .7, .8, and .9 in both clockwise and counter clockwise directions, as well as for  $\frac{\Omega b}{2V} = 0$  (static value).

## DATA PRESENTATION

Table II identifies the configurations tested and the corresponding appendix figure numbers which present the aerodynamic data. The aerodynamic coefficients vs.  $\frac{\Omega b}{2V}$  are presented for each configuration in six sequentially numbered figures in the following order:  $C_n$ ,  $C_l$ ,  $C_m$ ,  $C_N$ ,  $C_Y$ ,  $C_A$ . Each figure in turn consists of four (seven for the basic configuration) pages which present the subject aerodynamic coefficient vs.  $\frac{\Omega b}{2V}$  for the following angles of attack and spin radii, unless noted otherwise in Table II:

- |                                      |                        |
|--------------------------------------|------------------------|
| a) $\alpha = 8, 10, 12, 14, 16$ deg  | SR = 182.9 cm (72 in.) |
| b) $\alpha = 18, 20, 25, 30, 35$ deg | SR = 182.9 cm (72 in.) |
| c) $\alpha = 30, 35, 40, 45, 50$ deg | SR = 0                 |
| d) $\alpha = 55, 60, 70, 80, 90$ deg | SR = 0                 |

All the moment data are presented for a cg position of  $.21\bar{C}$ .

Lift coefficient vs. angle of attack for zero rotation rate is presented at the end of the Appendix for several configurations cited in Table II.

#### REFERENCES

1. Hultberg, Randy S.; Chu, Julio; Dickens, Waldo L.: Rotary Balance Data for a Typical Single-Engine General Aviation Design for an Angle-of-Attack Range of  $8^{\circ}$  to  $90^{\circ}$ . II - High-Wing Model C. NASA CR-3201, 1980.
2. Mechtly, E.A.: The International System of Units - Physical Constants and Conversion Factors. NASA SP-7012, 1973.
3. Bihle, William, Jr.; Hultberg, Randy S.; and Mulcay, William: Rotary Balance Data for a Typical Single-Engine Low-Wing General Aviation Design for an Angle-of-Attack Range of  $30^{\circ}$  to  $90^{\circ}$ . NASA CR-2972, 1978.



TABLE I.- DIMENSIONAL CHARACTERISTICS OF THE BASIC MODEL

Overall length, m (ft) . . . . . 1.31 (4.29)

Wing:

Span, m (ft) . . . . . 1.66 (5.46)

Area, m<sup>2</sup> (ft<sup>2</sup>) . . . . . .38 (4.06)

Root chord, cm (in.) . . . . . 22.32 (8.79)

Tip chord, cm (in.) . . . . . 22.32 (8.79)

Mean aerodynamic chord, cm (in.) . . . . . 22.32 (8.79)

Leading edge of  $\bar{c}$ , distance rearward of leading

edge of root chord, cm (in.) . . . . . 0.0 (0.0)

Aspect ratio . . . . . 7.4

Dihedral, deg . . . . . 6.5

Incidence:

Root, deg . . . . . +3.257

Tip, deg . . . . . +1.0

Airfoil Section NACA 63<sub>2</sub> A415

Horizontal tail:

Span, m (ft) . . . . . 0.54 (1.78)

Incidence, deg . . . . . 0.0

Airfoil section . . . . . NACA 63A<sub>1</sub> 012(modified)

Vertical tail:

Airfoil section . . . . . NACA 63A<sub>1</sub>012

Sweep @ LE, deg . . . . . 41.0

TABLE II.- CONFIGURATIONS TESTED AND FIGURE INDEX  
(Unless noted otherwise, all configurations tested through  $\alpha=8$  to  $90^\circ$  at  $\beta=0^\circ$ .)

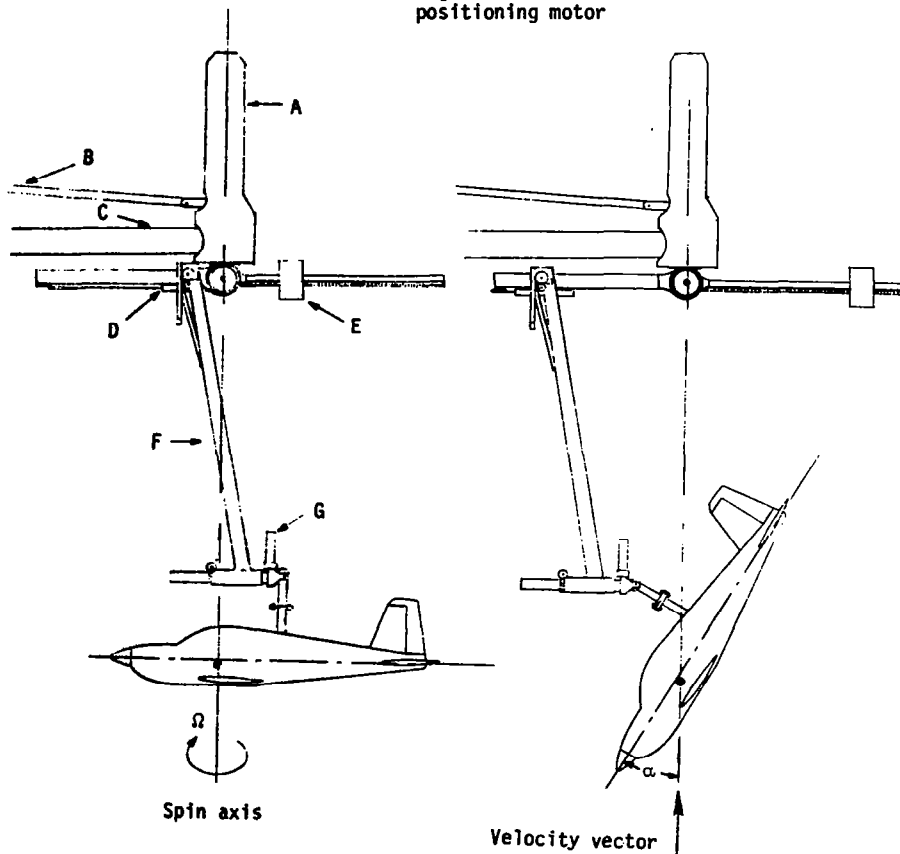
FIGURE NO.	CONFIGURATION	$\delta_e$ deg	$\delta_a$ deg	$\delta_r$ deg	REMARKS
A1-A6	Basic	0	0	0	also $\alpha=8-60^\circ$ SR=6" $\beta=10^\circ$
A7-A12		0	0	0	
A13-A18		-15	20 up +10down -20up -10down	-25	
A19-A24		0	0	0	
A25-A30		0	0	0	
A31-A36	Full-span LE wing droop w/moderate nose radius	0	0	0	
A37-A42	w/large nose radius	0	0	0	
A43-A48	and sharp edge	0	0	0	
A49-A54	fuselage bottom	0	0	0	
A55-A60	Outboard LE wing droop w/large nose radius having inboard	0	0	0	
A61-A66	fairing	0	0	0	
A67-A72	Outboard LE wing droop w/large nose radius	0	20 up +10down	0	$\beta=10^\circ$
A73-A78	Sharp-edge fuselage bottom	0	0	0	
A79-A84	Basic configuration with cowl strakes, ventral and tail	0	0	0	
A85-A90	fillets	off	0	off	
A91-A96	Horiz. tail off	0	0	0	
A97-A102	Vert. tail off	off	off	off	
A103-A108	Horiz. and vert. tail off	off	off	off	
A109-A114	Body alone	0	0	0	
A115-A120	Wing off	0	0	0	
A121-A126	Wing and horiz. tail off	off	off	off	
A127-A132	Wing and vert. tail off	0	0	0	
A133-A138	Dorsal fin off	0	0	0	
A139-A144	T Tail	0	0	0	
A145-A150	↓	-15	-15	-25	
A151-A156	#1 Horiz. tail	0	0	0	
A157-A162	Basic configuration with cowl strakes, tail fillets and	-15	-15	-25	
A163-A168	emergency spin chute installation.	0	0	0	
	Basic configuration with cowl strakes and tail fillets	0	0	0	

<sup>a</sup>  $C_L$  vs.  $\alpha$  presented in figure A169



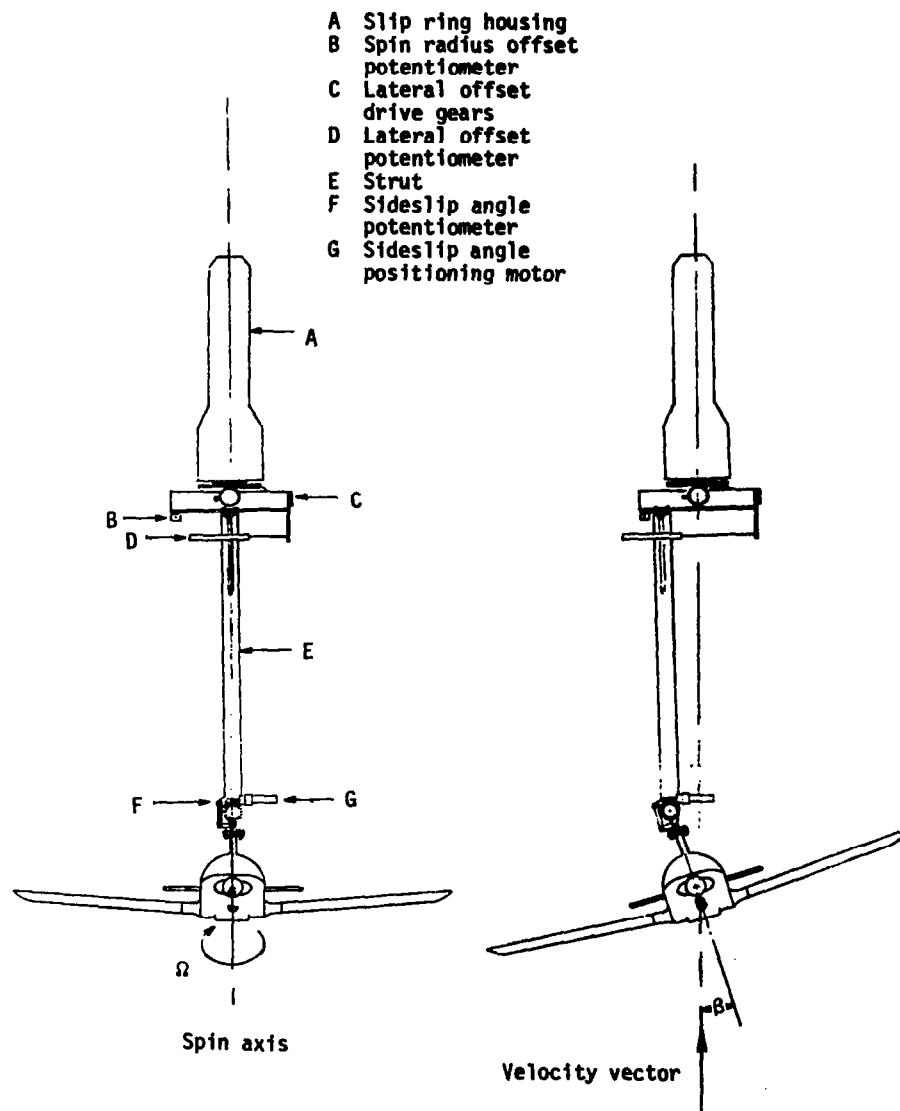
Figure 1. - Photograph of 1/6-scale model installed on rotary balance apparatus.

- A Slip ring housing
- B Drive shaft
- C Support boom
- D Spin radius offset potentiometer
- E Counterweight
- F Strut
- G Angle of attack positioning motor



(a) Side view of model.

Figure 2.- Sketch of rotary balance apparatus.



(b) Front view of model.

Figure 2.- Concluded.

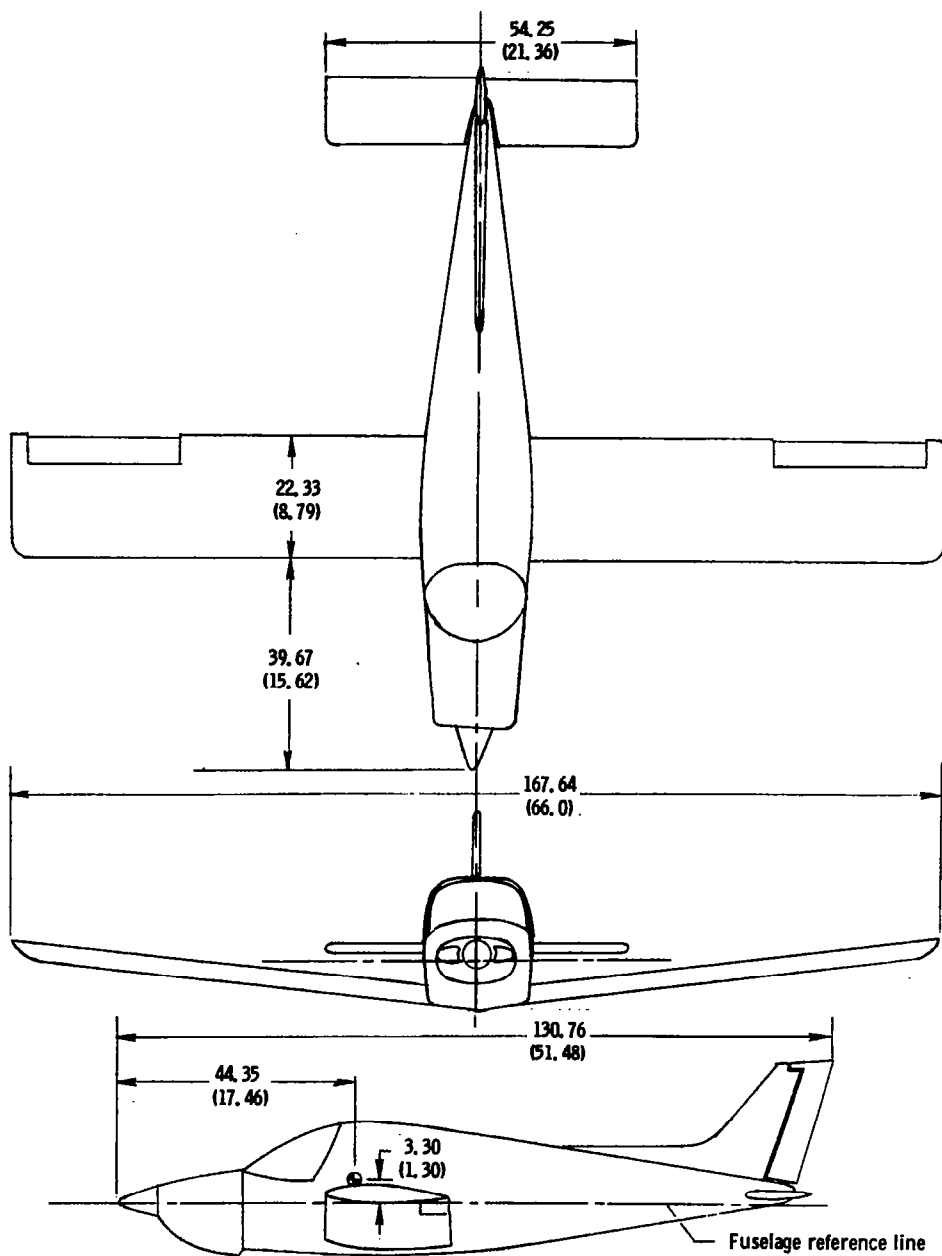


Figure 3. - Three-view drawing of 1/6-scale low-wing general aviation model C. Center-of-gravity positioned at 0.21  $\bar{c}$ . Dimensions are given in centimeters (inches), model scale.

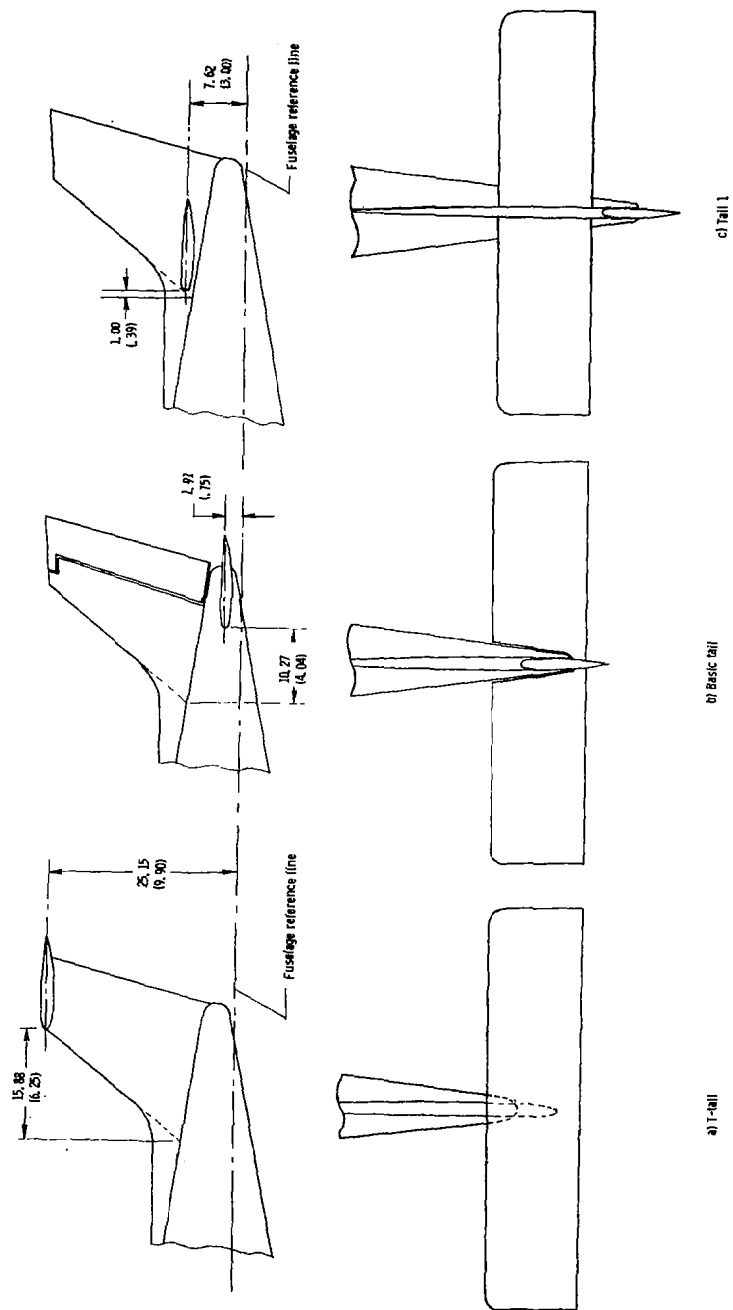


Figure 4. - Tail configurations tested on the model. Dimensions are given in centimeter/inches, model scale.

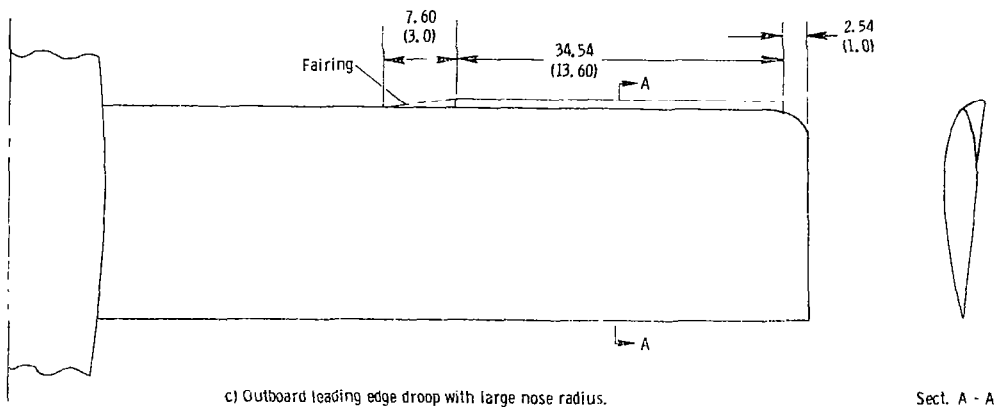
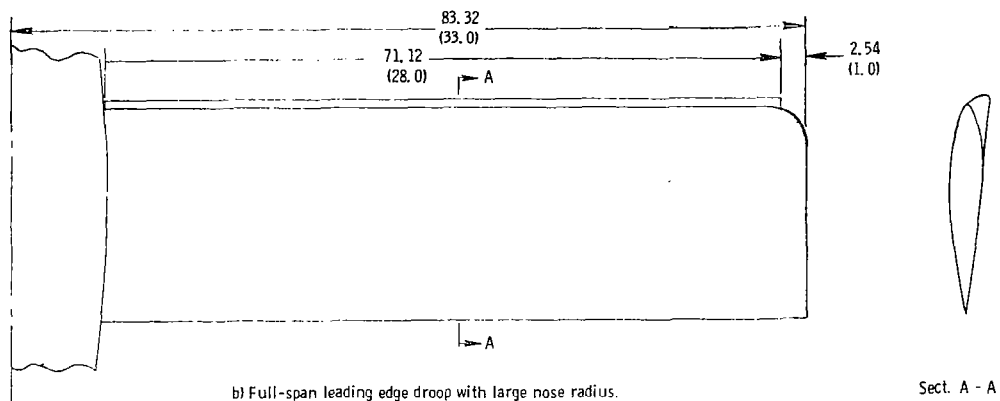
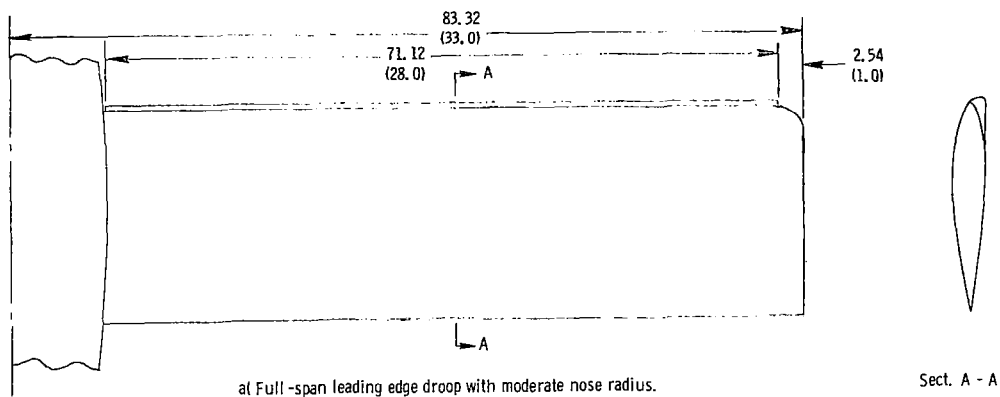
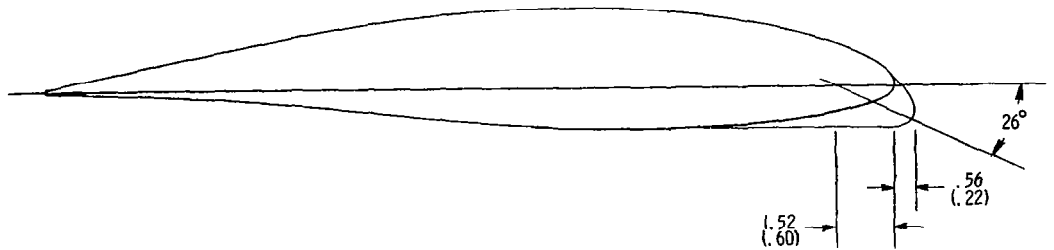


Figure 5. -Wing leading edge modifications tested on model. Dimensions are given in centimeters(inches), model scale.

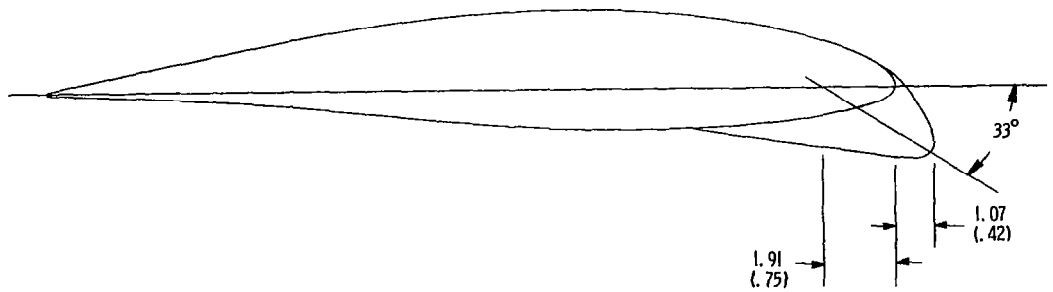




a) Basic airfoil



b) Basic airfoil with moderate nose radius



c) Basic airfoil with large nose radius

Figure 6. - Airfoil sections tested on model. Dimensions are given in centimeters (inches) model scale.

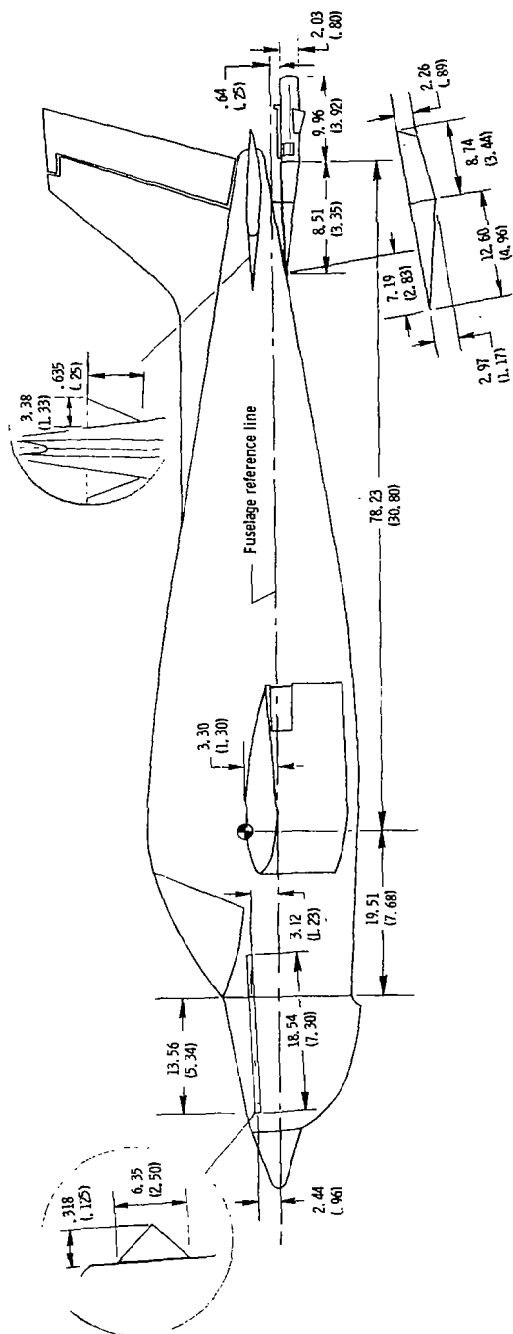


Figure 7 - Fuselage tested with cowl strakes, tail fillers, ventral fin and emergency spin chute installation. Dimensions are given in centimeters (inches), model scale.

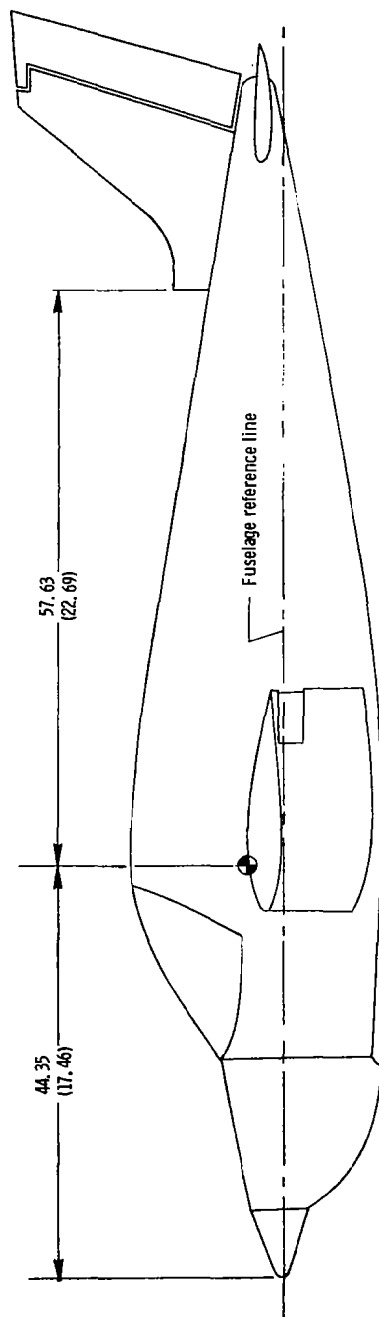


Figure 3. - Dorsal fin off configuration tested on the model. Dimensions are given in centimeters(inches), model scale.

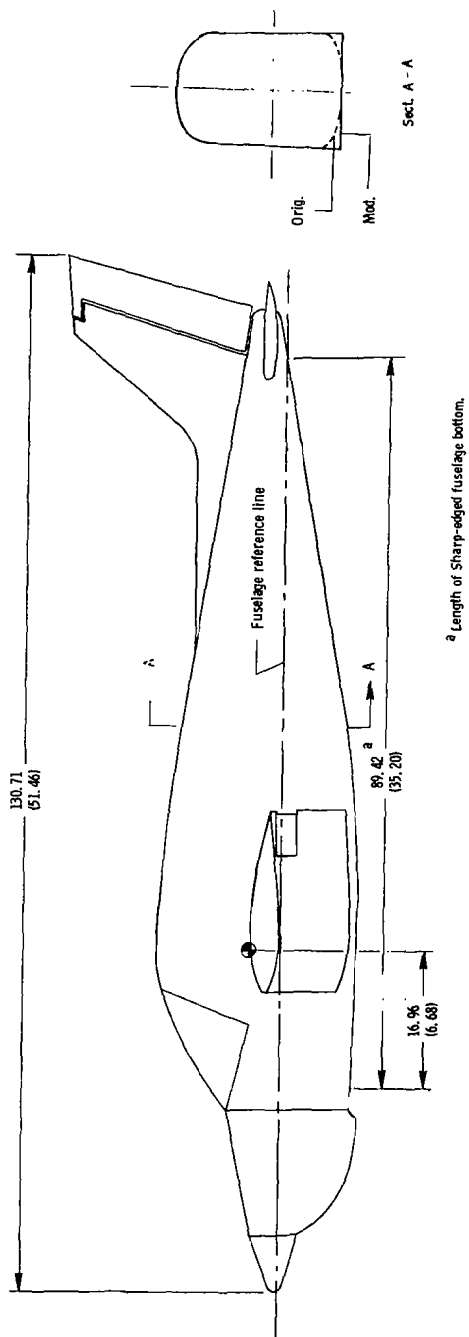


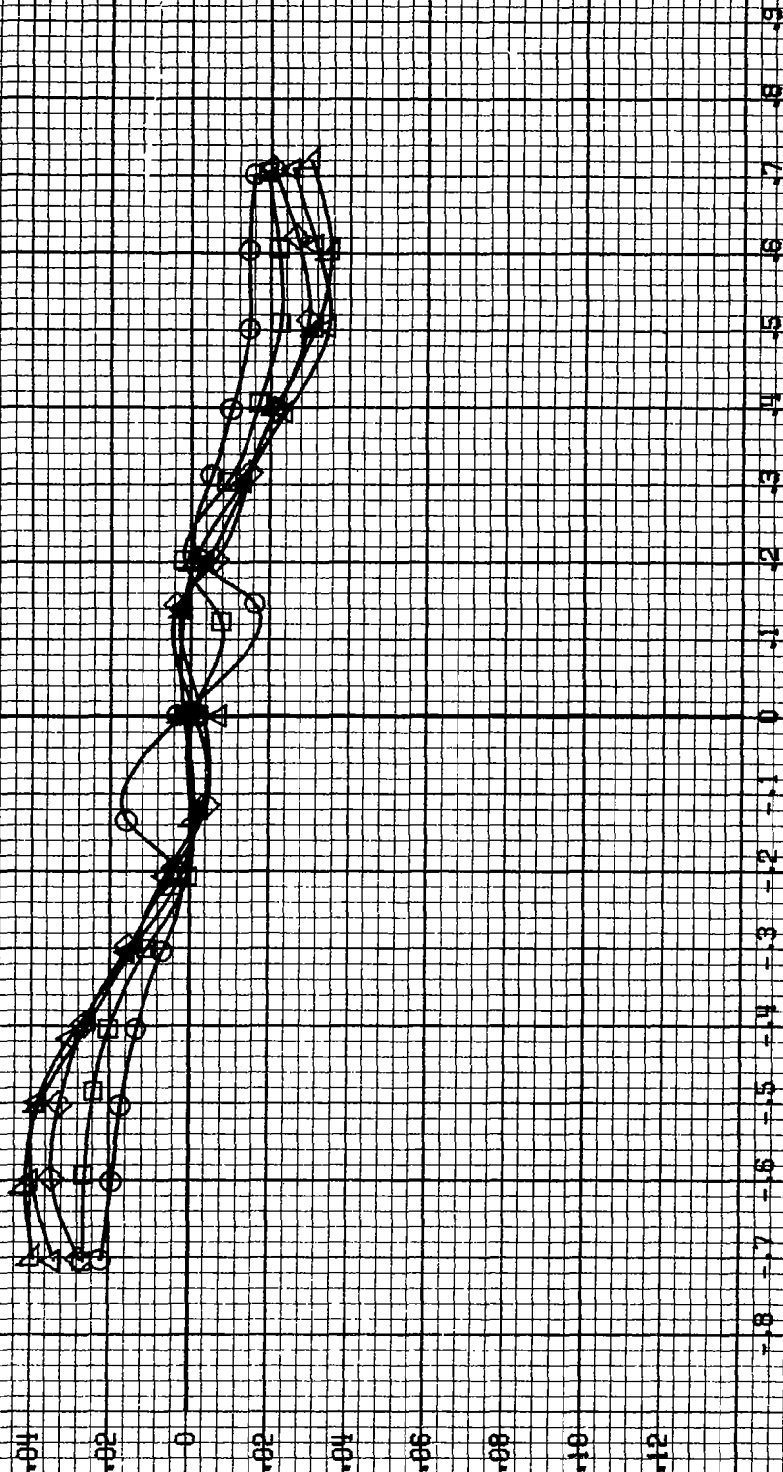
Figure 9. - Sharp-edged fuselage bottom modification tested on the model. Dimensions are given in centimeters (inches), model scale.

## APPENDIX

$\alpha$ , deg  
 ○ 8  
 □ 10  
 ◇ 12  
 △ 14  
 ▲ 16

Fig 2

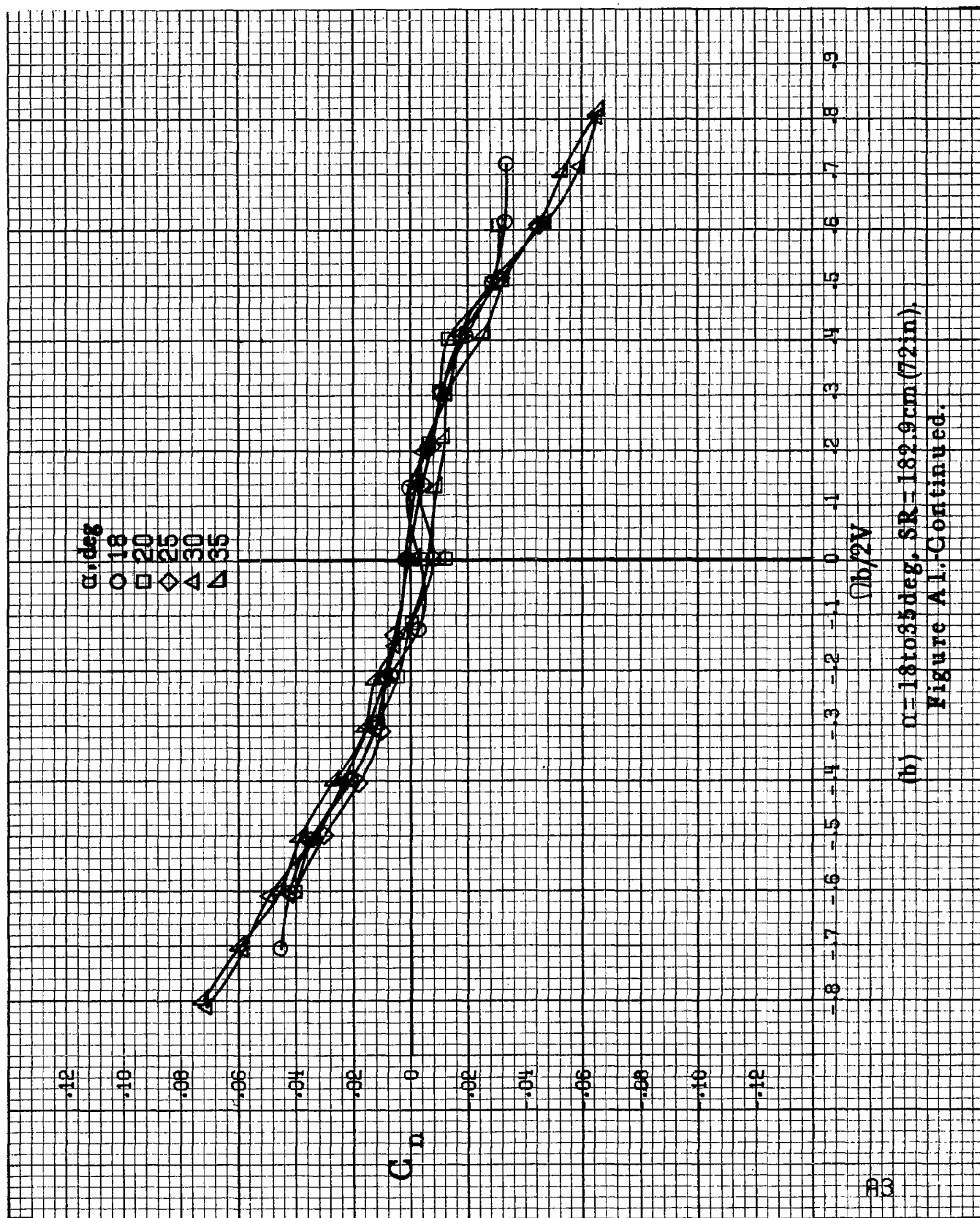
$C_n$



(b/2V)

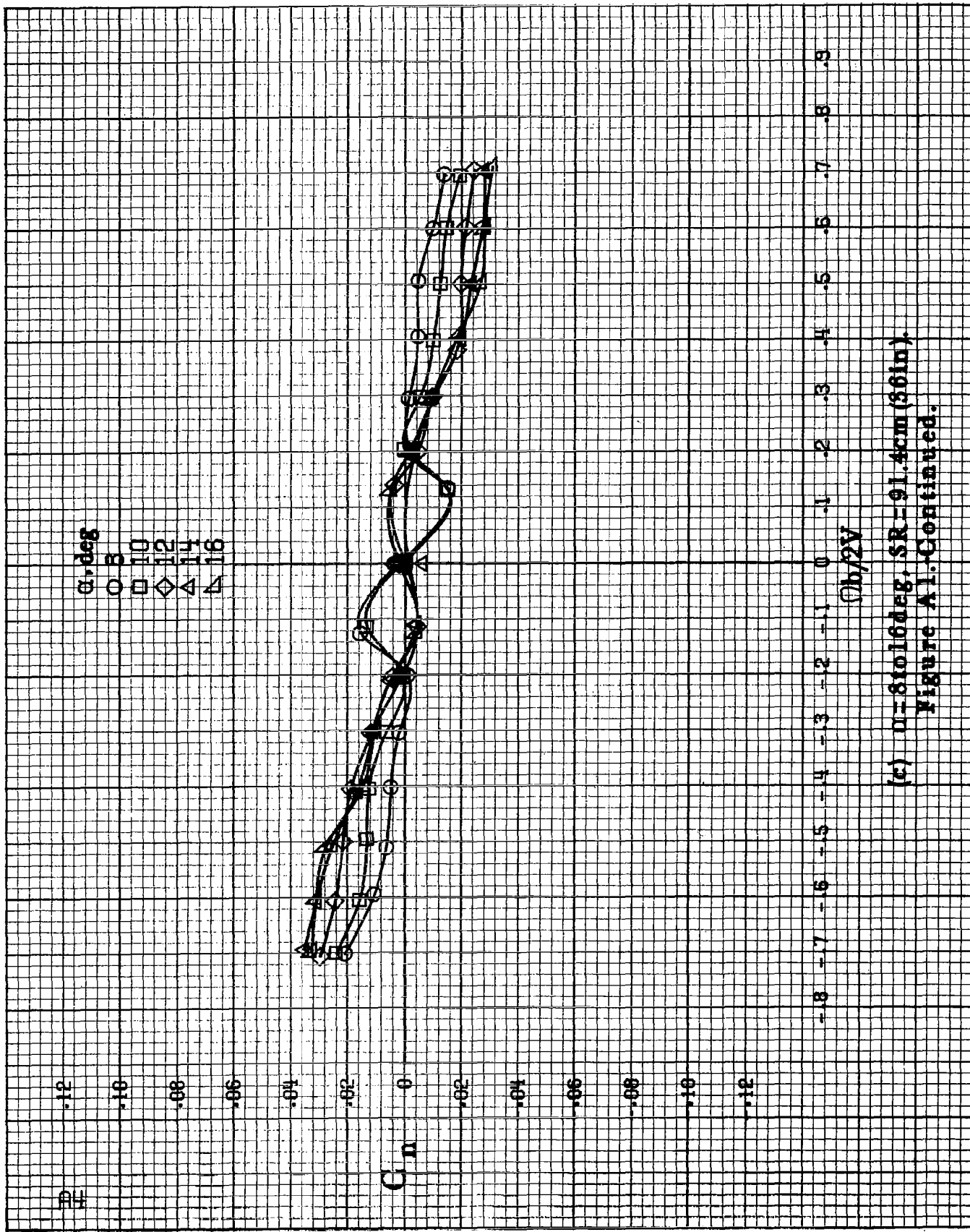
(a)  $\alpha = 8^\circ$  to  $16^\circ$ ,  $SR = 182.9 \text{ cm} (72 \text{ in})$ .

Figure A1. Effect of rotation rate and angle of attack on yawing-moment coefficient for basic configuration.  $\delta = 0^\circ$ ,  $\delta_A = 0^\circ$ ,  $\delta_F = 0^\circ$ ,  $\delta = 0^\circ$ .



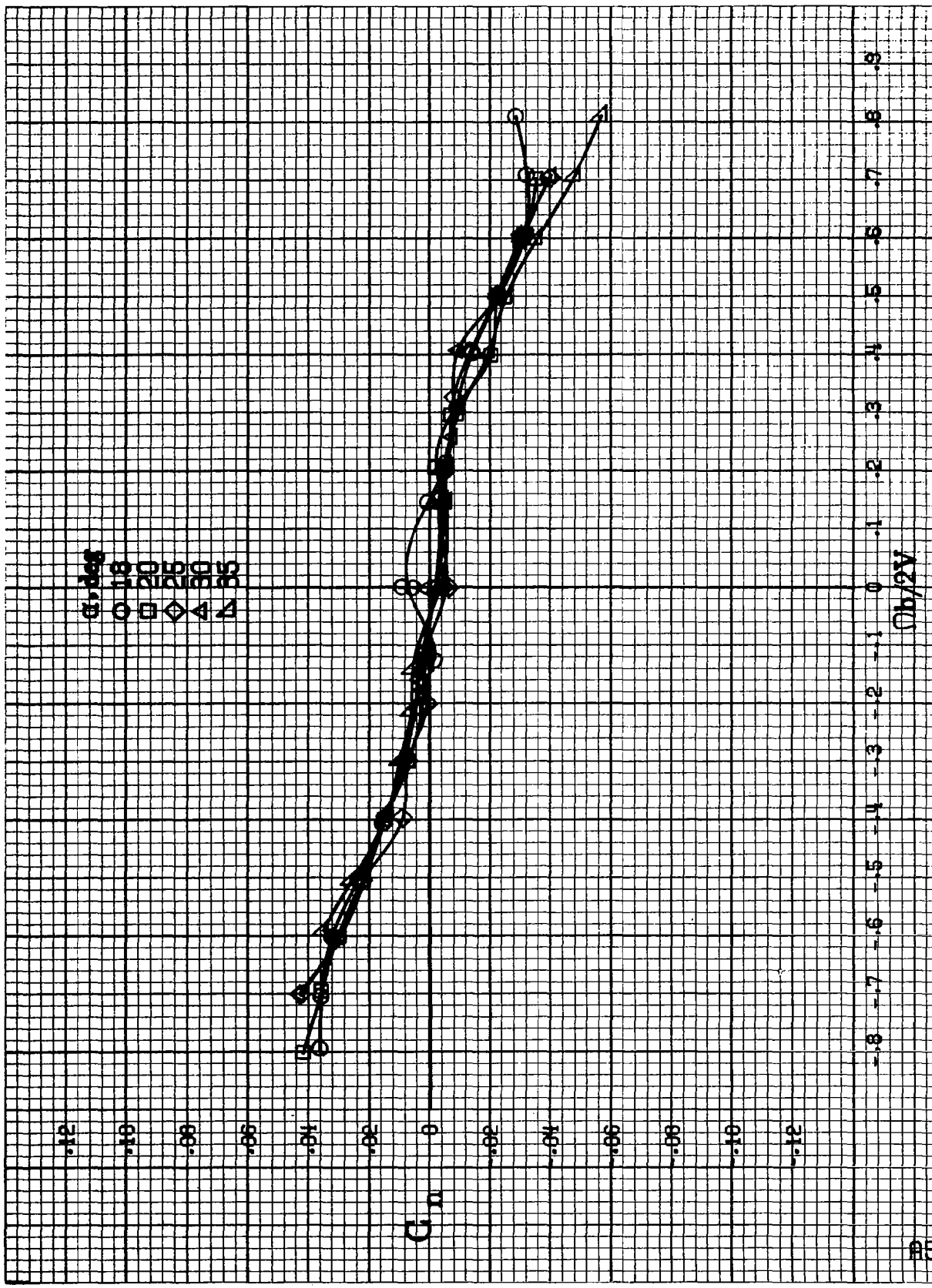
(b)  $\alpha=18$  to  $35^\circ$ ,  $SR=182.9\text{cm}$  (72 in).

Figure A1. Continued.



(c)  $\alpha=8$  to  $16$  deg, SR-91.4cm (86in).  
Figure A1-Continued.





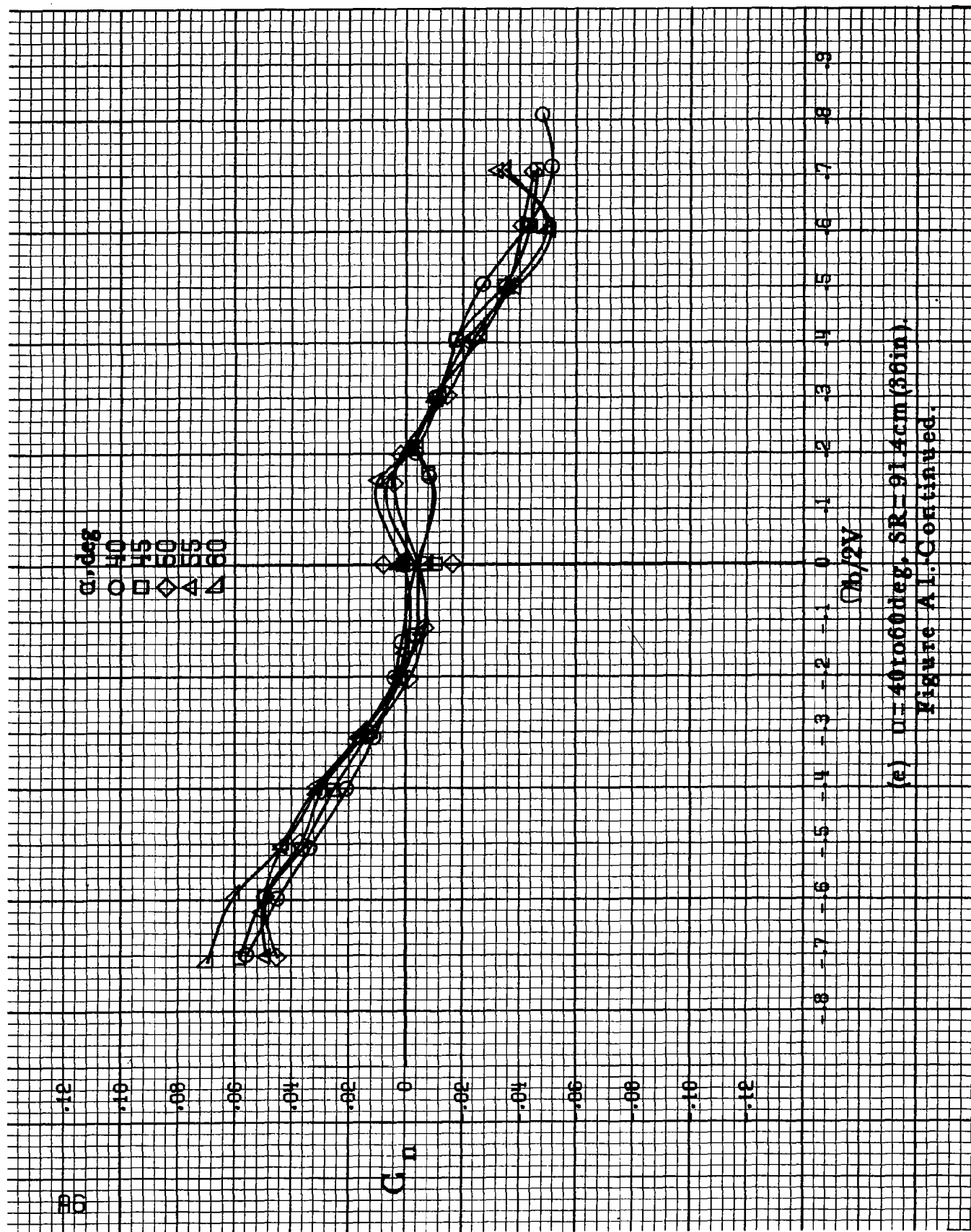
(d)  $\alpha=18$  to  $35^\circ$ ,  $SR=91.4\text{cm (36in.)}$   
Figure A1-Continued.

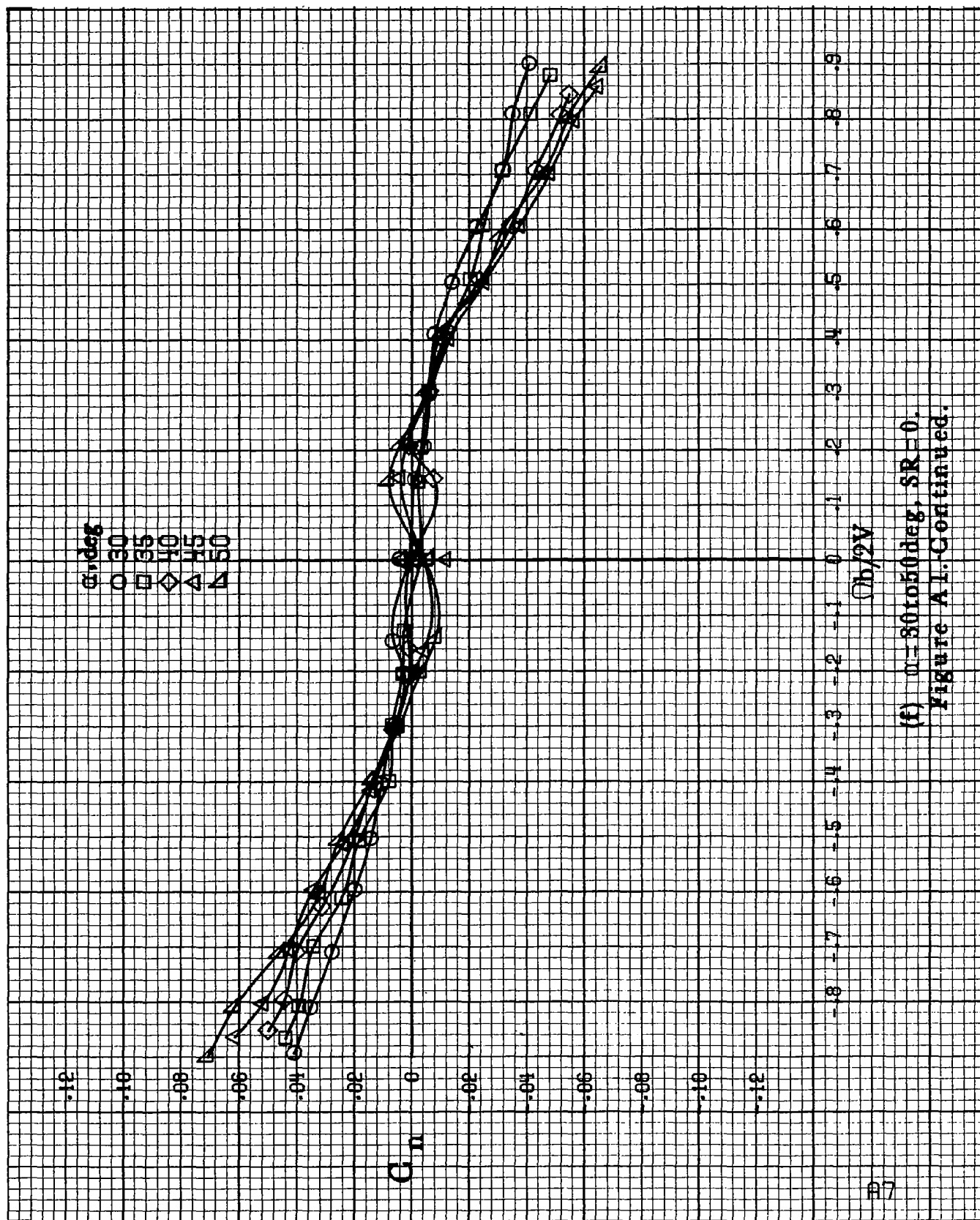
$\alpha$ , deg  
 ○ 40  
 □ 45  
 ◇ 50  
 △ 55  
 ▽ 60

$C_n$

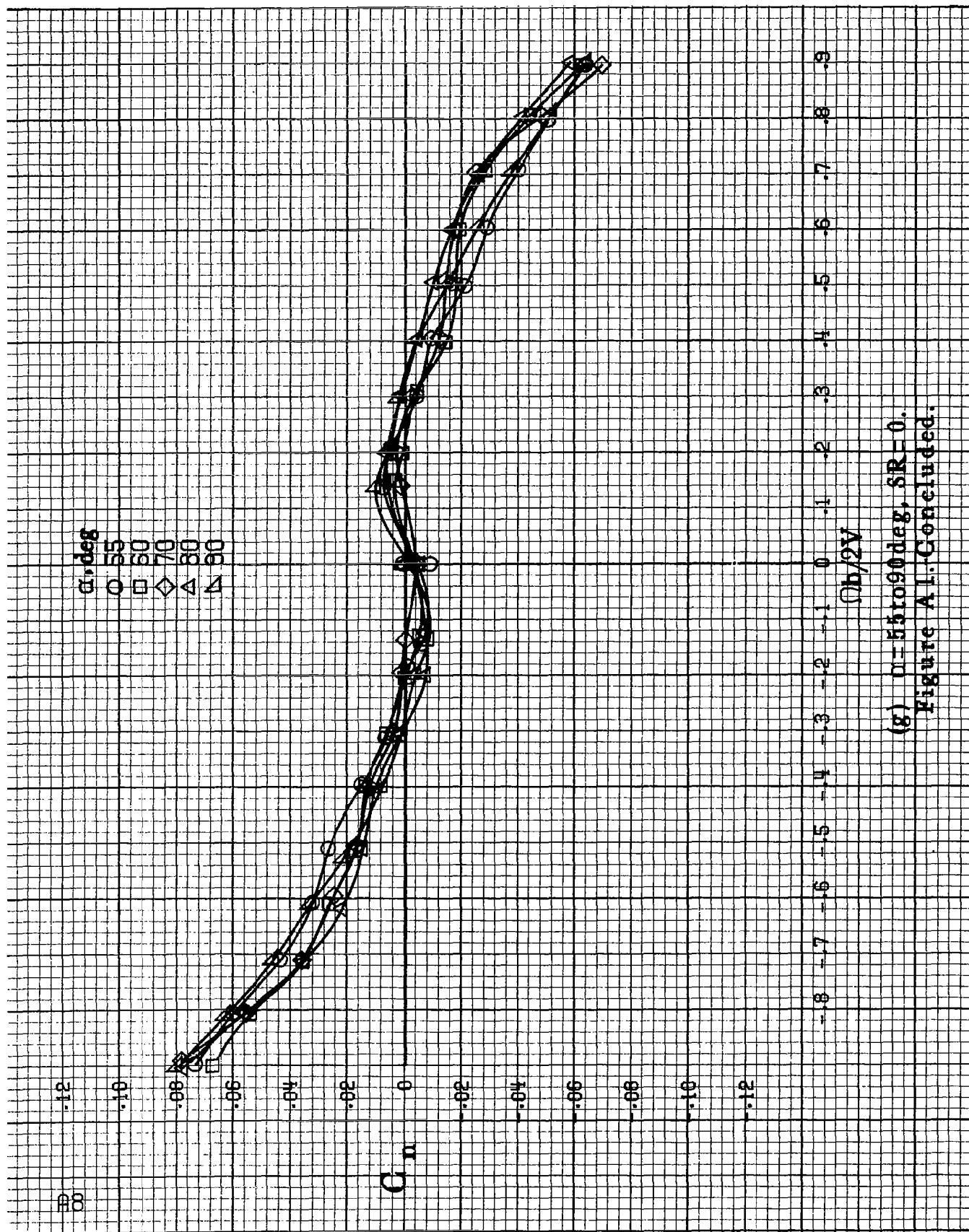
$(D_0/2V)$

(a)  $U=40$  to  $60$  deg,  $SR=91.4$  cm (36 in).  
 Figure A1. Continued.

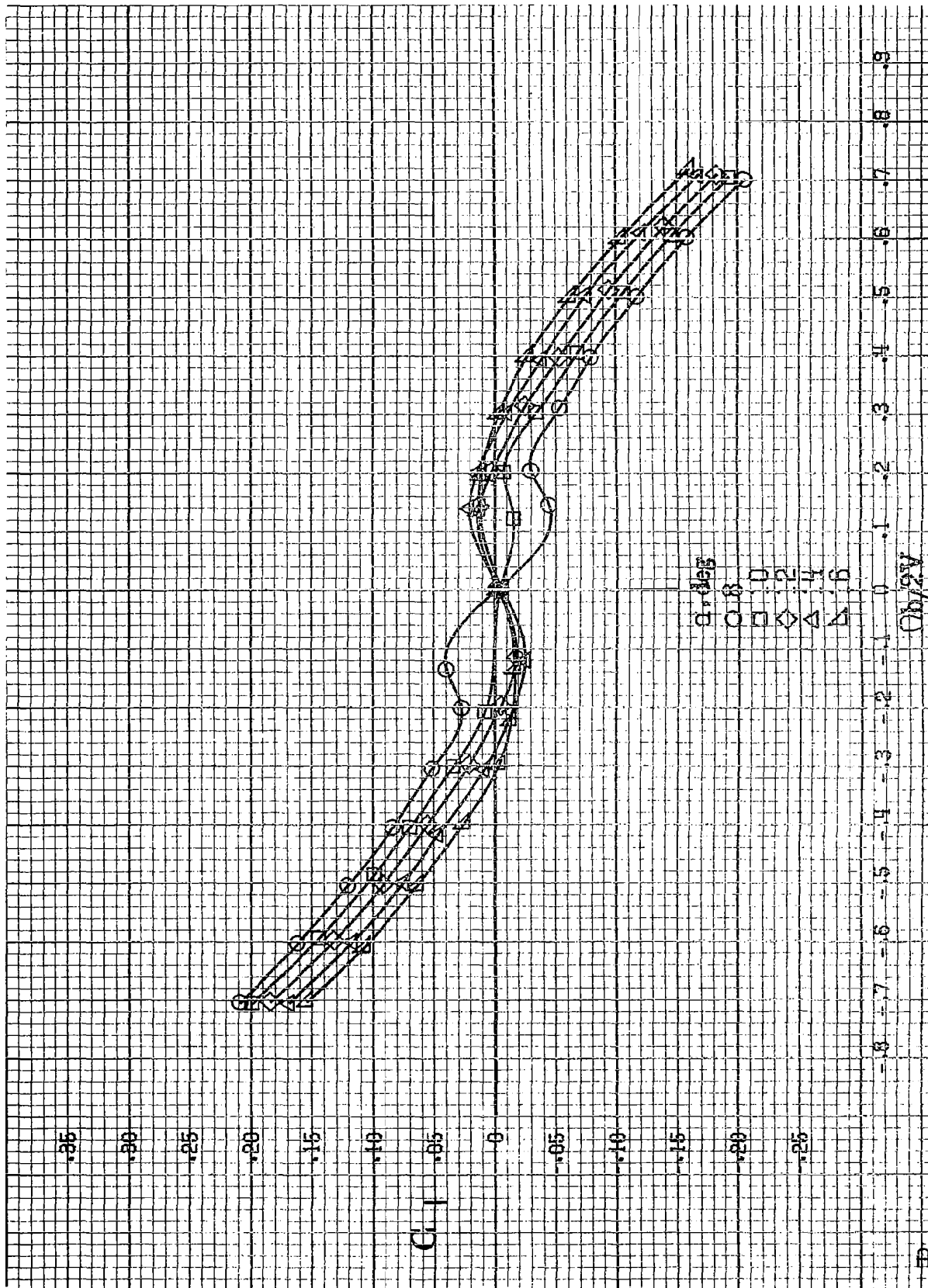




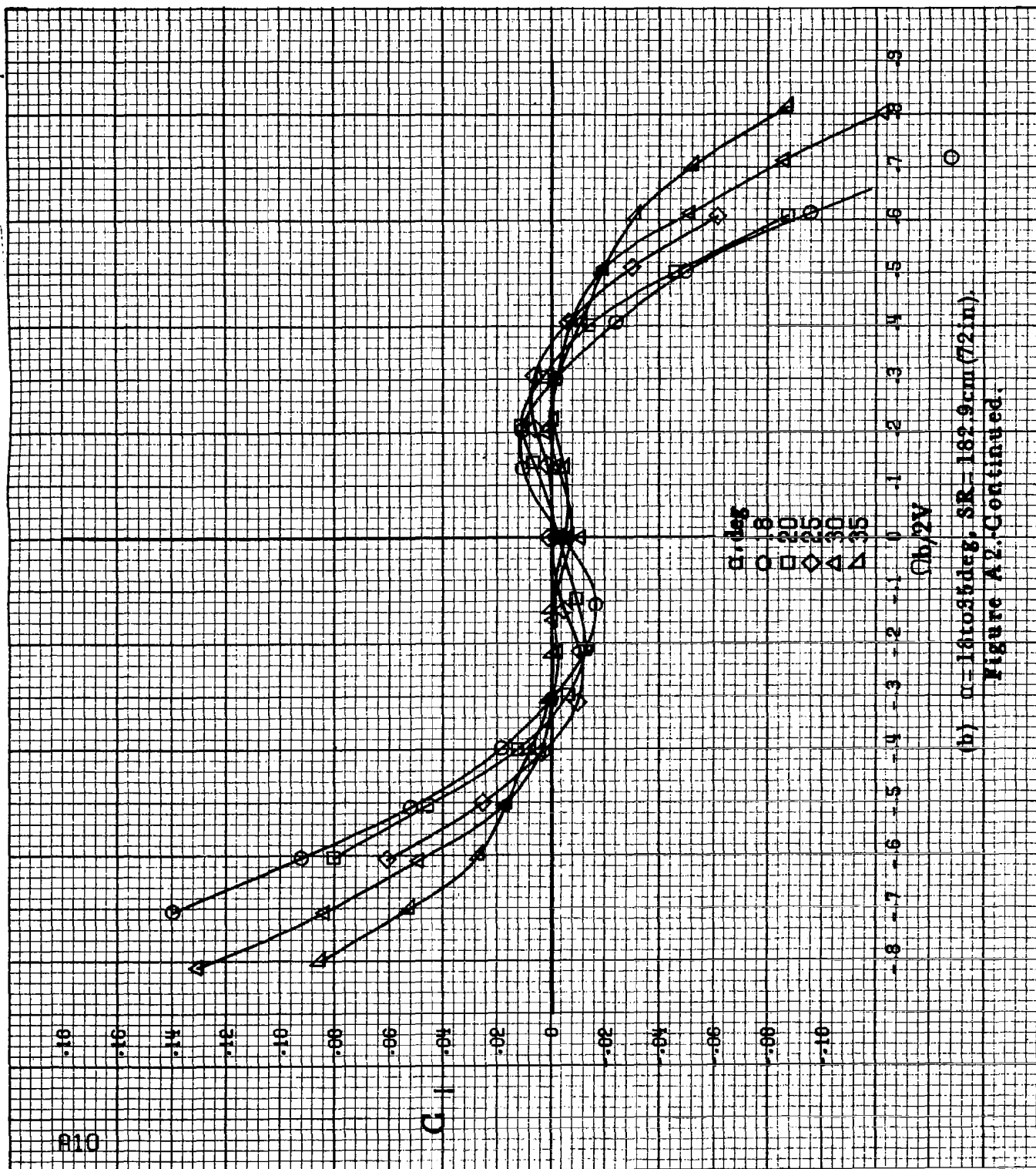
(f)  $\alpha=30$  to  $50^\circ$ ,  $SR=0$ .  
Figure A1. Continued.



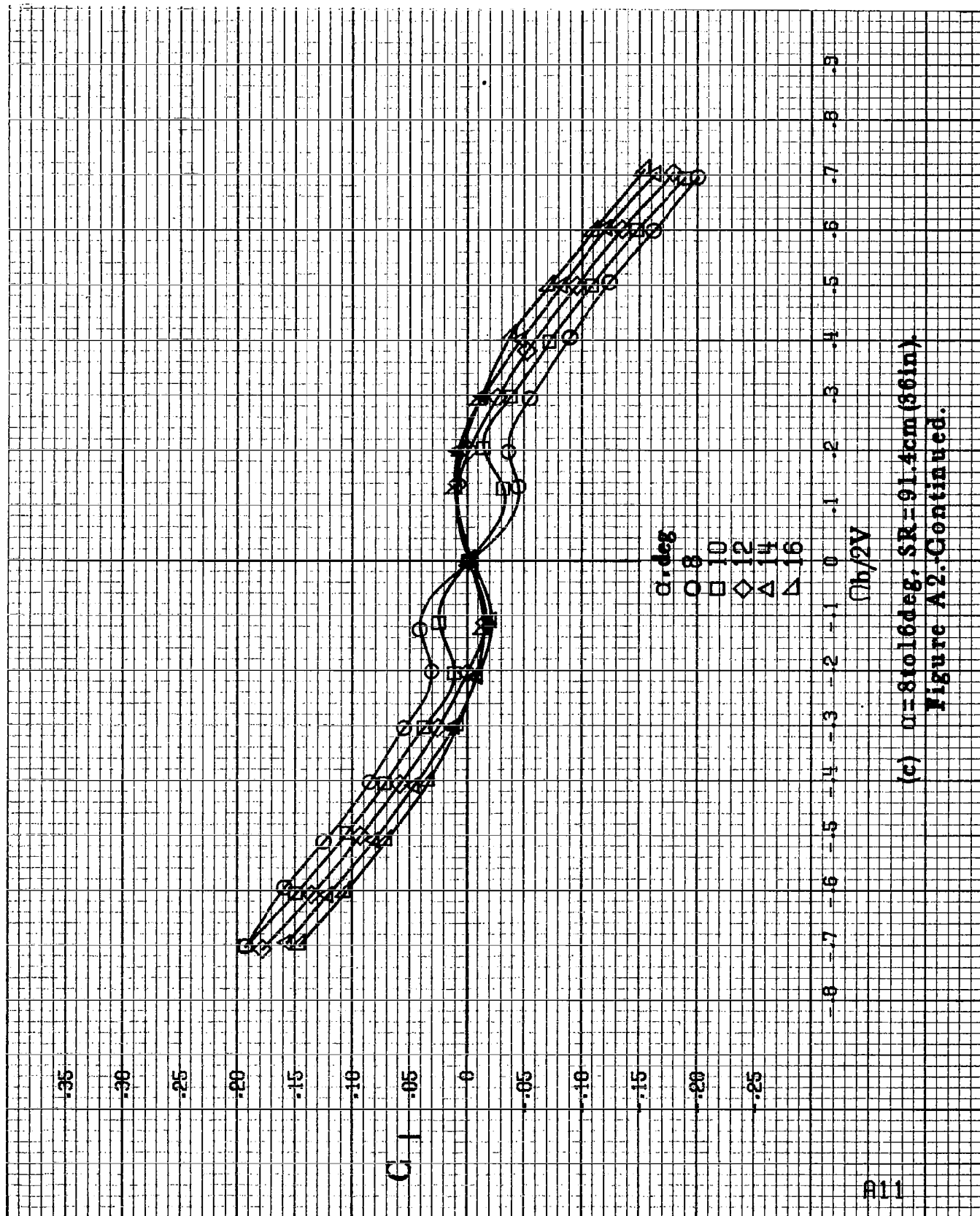
(g)  $\alpha = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A1. Concluded.



(a)  $\alpha = 8.016428$ ,  $SR = 132.9 \text{ cm} (72 \text{ in})$ .  
 Figure A2. Effect of rotation rate and angle of attack on rolling moment coefficient for basic configuration.  $\delta_1 = 0^\circ$ ,  $\delta_2 = 0^\circ$ ,  $\delta_3 = 0^\circ$ ,  $\delta_4 = 0^\circ$ .



(b)  $\alpha = 15$  to  $35$  deg, SR = 162.9 cm (72 in).  
Figure A2-Continued.



(c)  $\alpha = 8$  to  $16^\circ$ ,  $SR = 91.4 \text{ cm (36 in.)}$   
Figure A2-Continued.

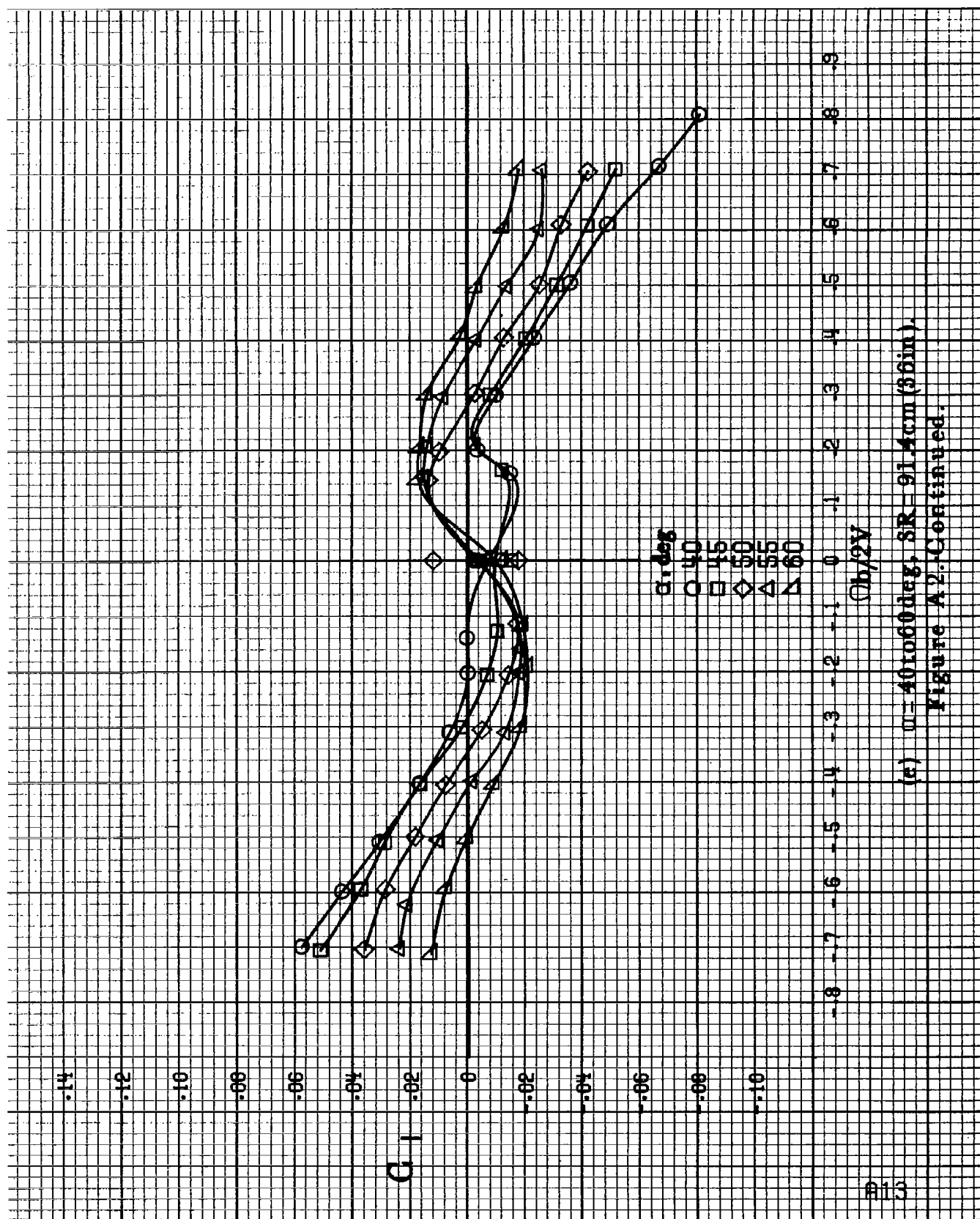
#12

C



(d)  $\alpha = 18$  to  $35$  deg,  $SR = 91.4$  cm (36 in).  
Figure A2-Continued.





(a)  $\alpha = 40$  to  $60$  deg,  $SR = 91.4 \text{ cm (36 in.)}$ .

Figure A2. Continued.

$C_1$

$\alpha, \text{deg}$

○ 30

□ 35

◇ 40

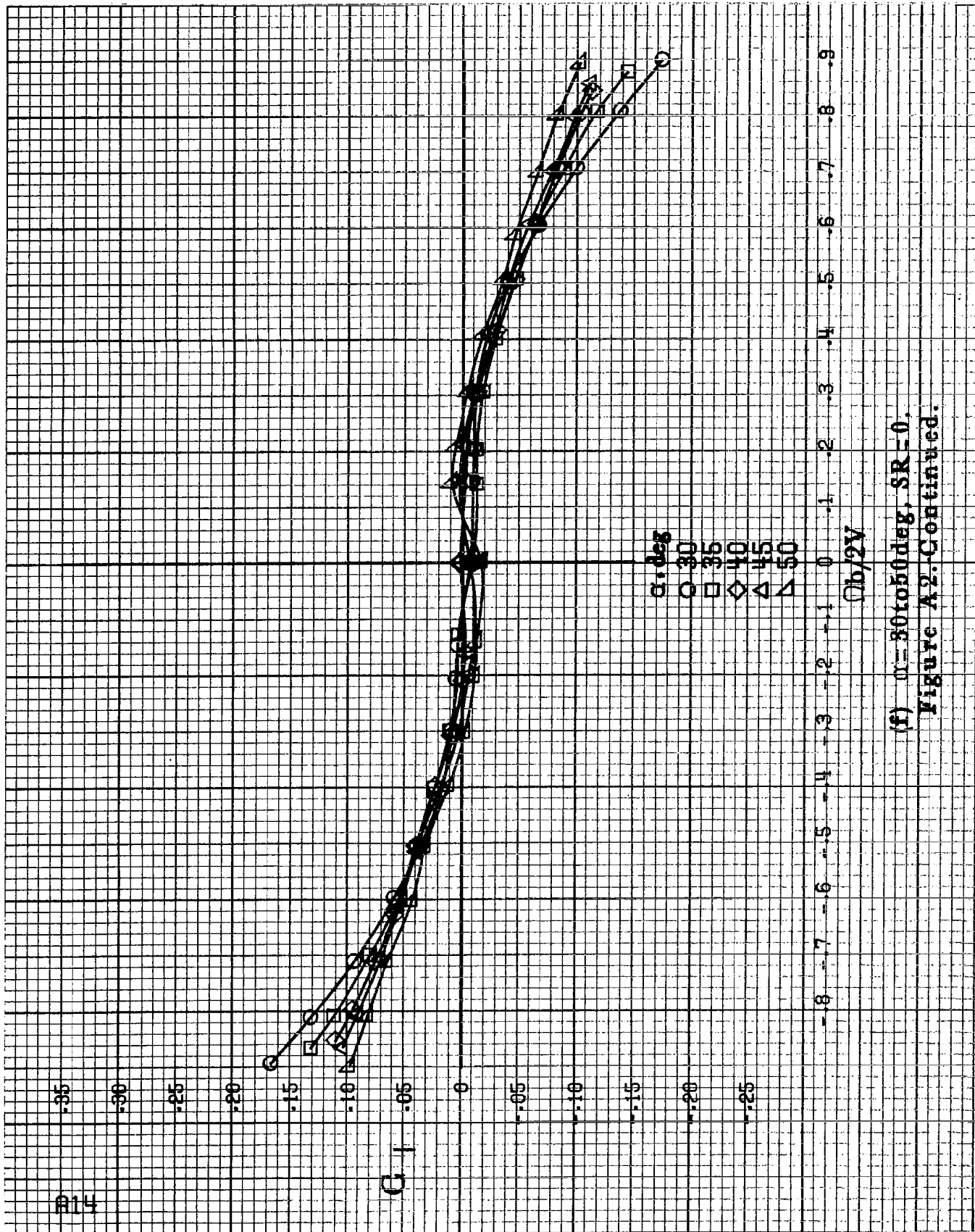
△ 45

▽ 50

$\Omega b/2V$

(f)  $\alpha=30$  to  $50$  deg,  $SR=0$ .

Figure A2-Continued.



-14

-12

-10

-08

-06

-04

-02

0

.02

.04

.06

.08

.10

C<sub>1</sub>

$\alpha, \text{deg}$

○ 55

□ 60

◇ 70

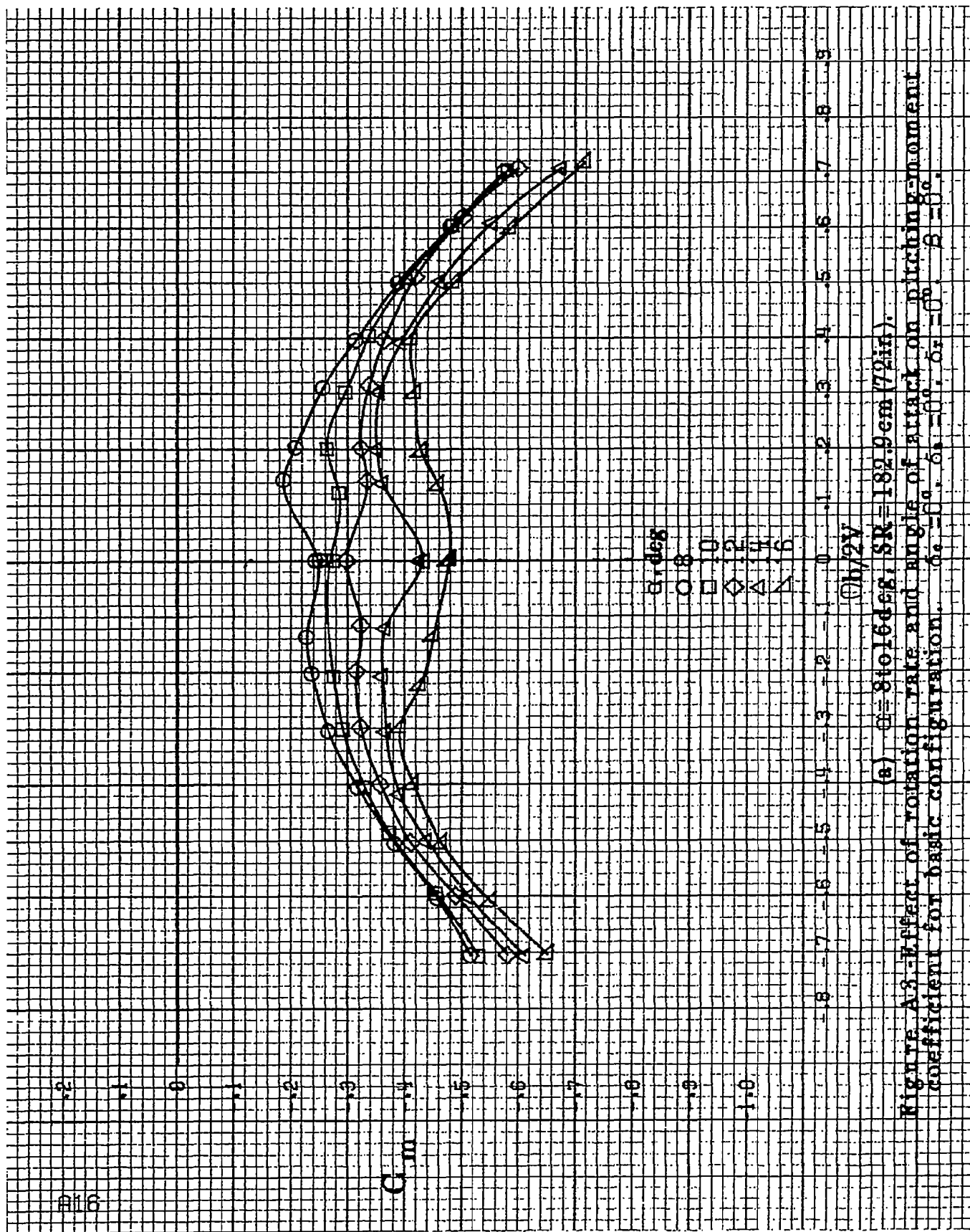
△ 80

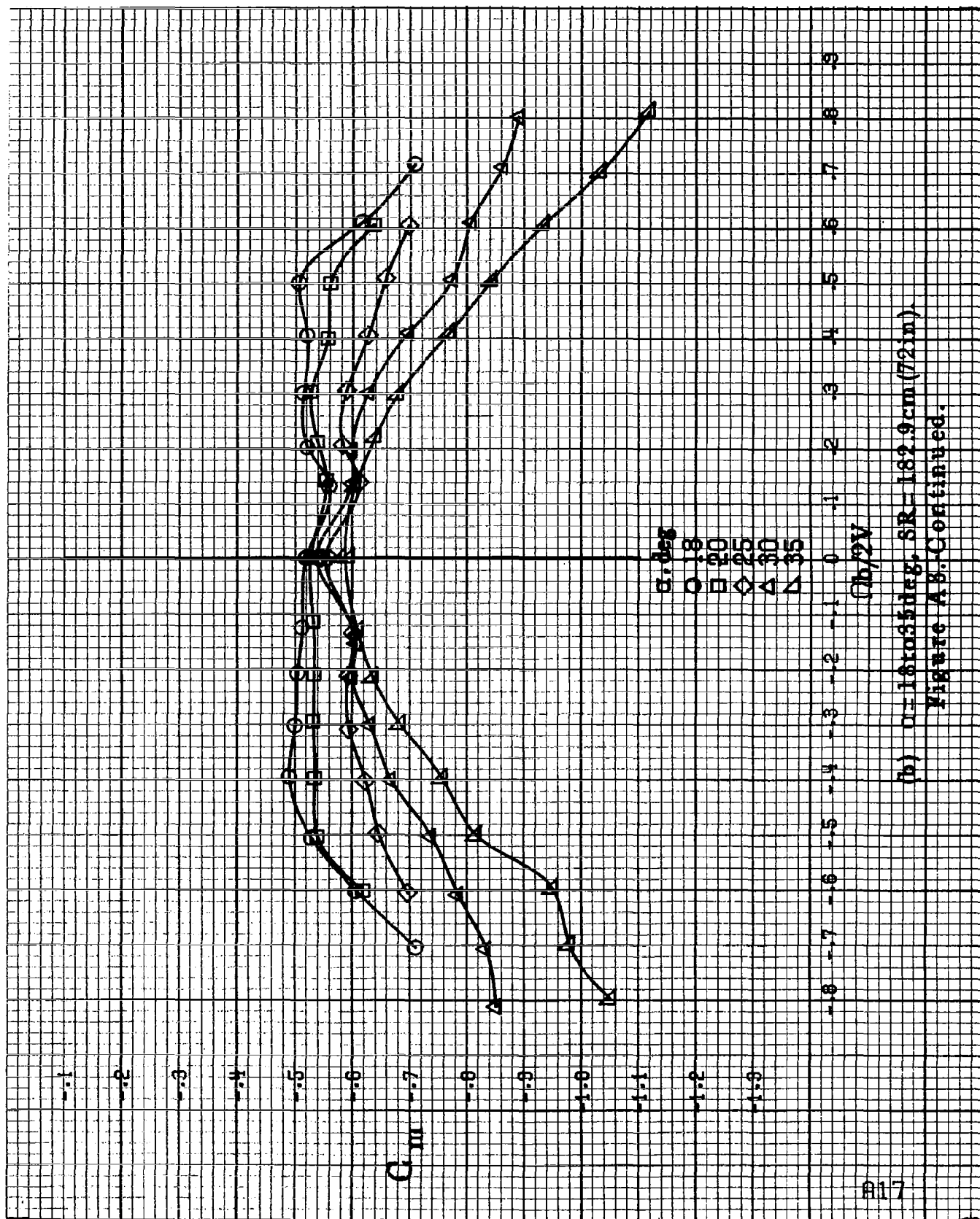
▽ 90

$\phi_b/2V$

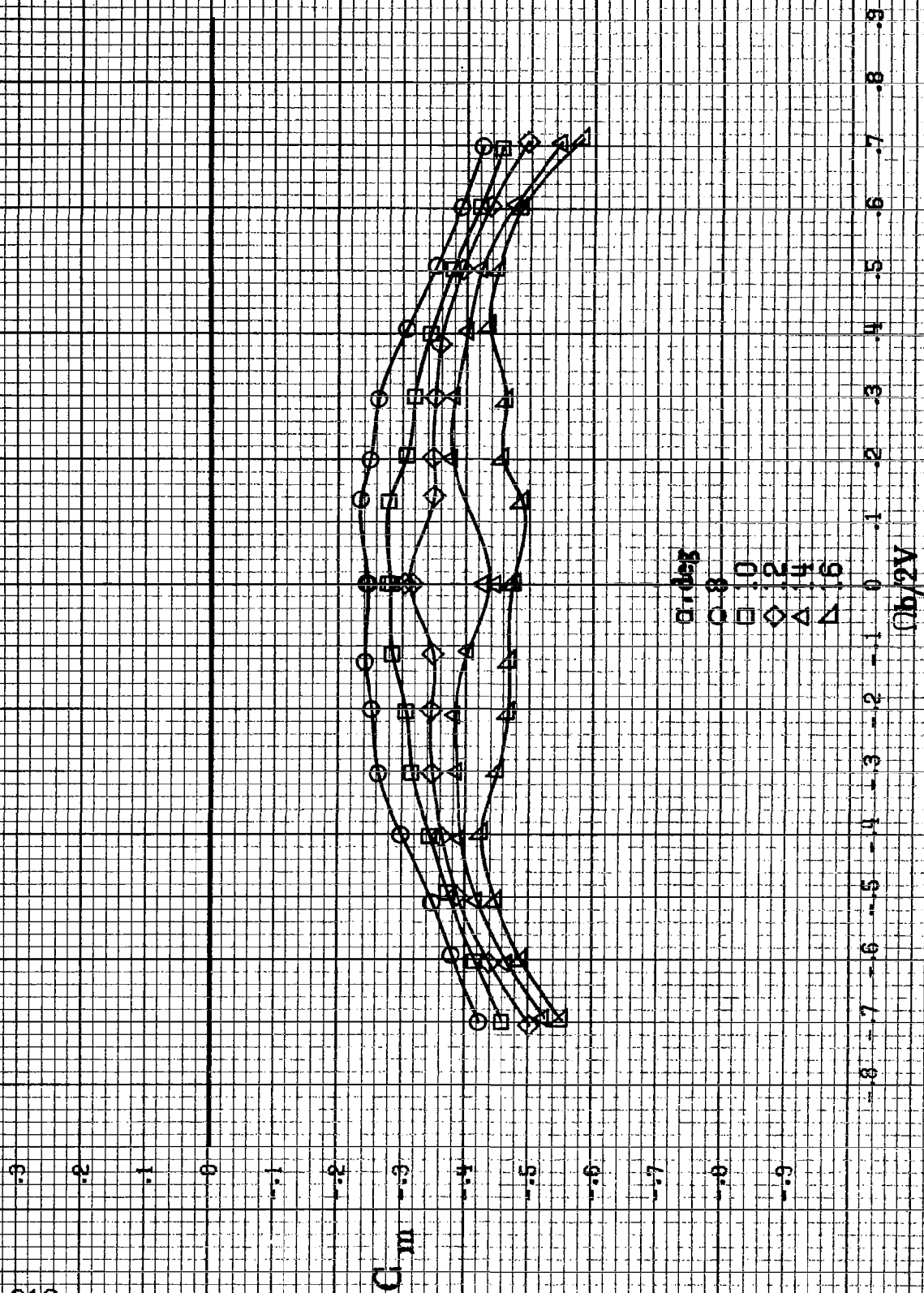
(g)  $\alpha = 55$  to  $90$  deg,  $SR = 0$ .

Figure A2: Concluded.



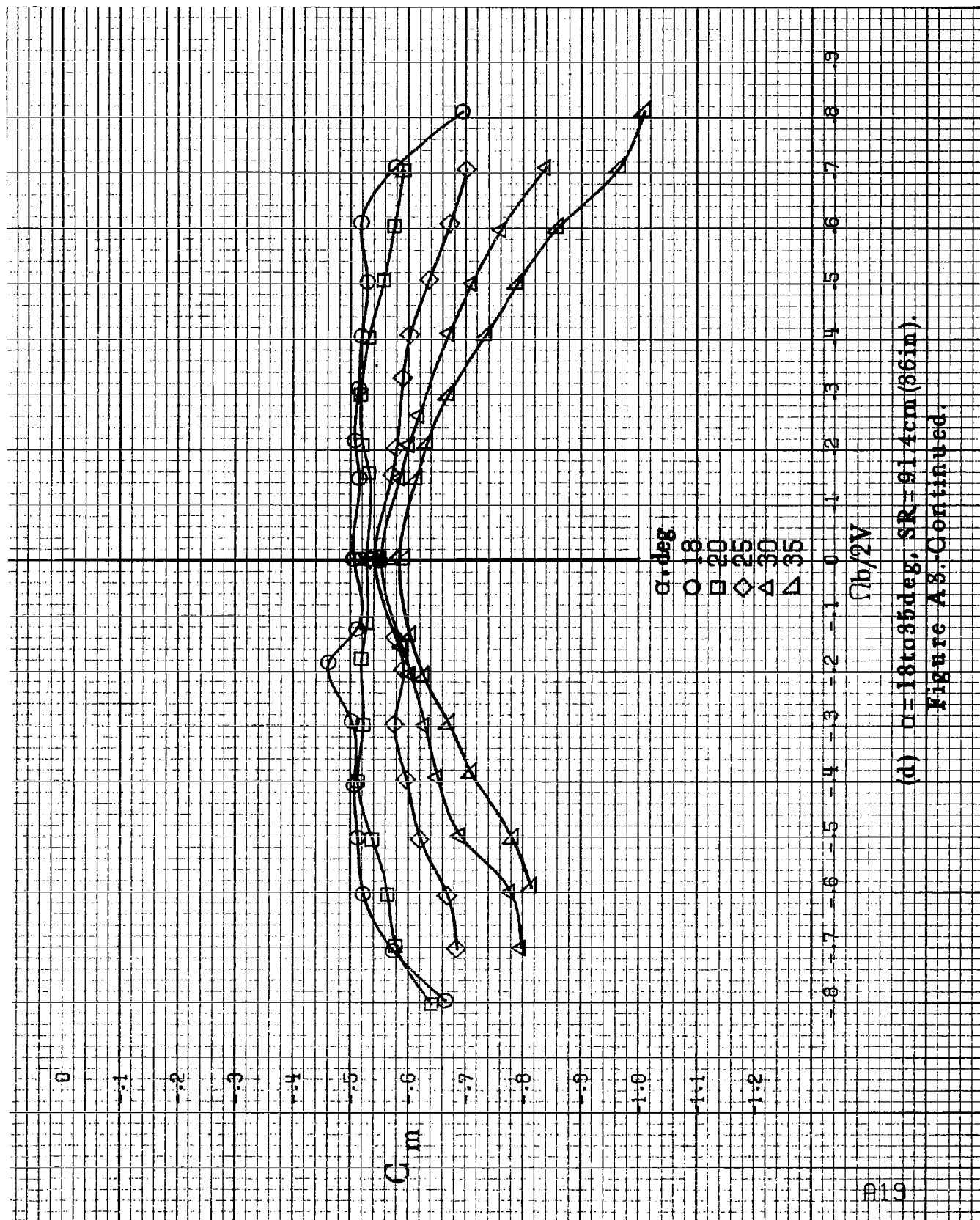


(b)  $\sigma = 18$  to  $55$  deg,  $SR = 182.9$  cm (72 in).  
Figure A3. Continued.



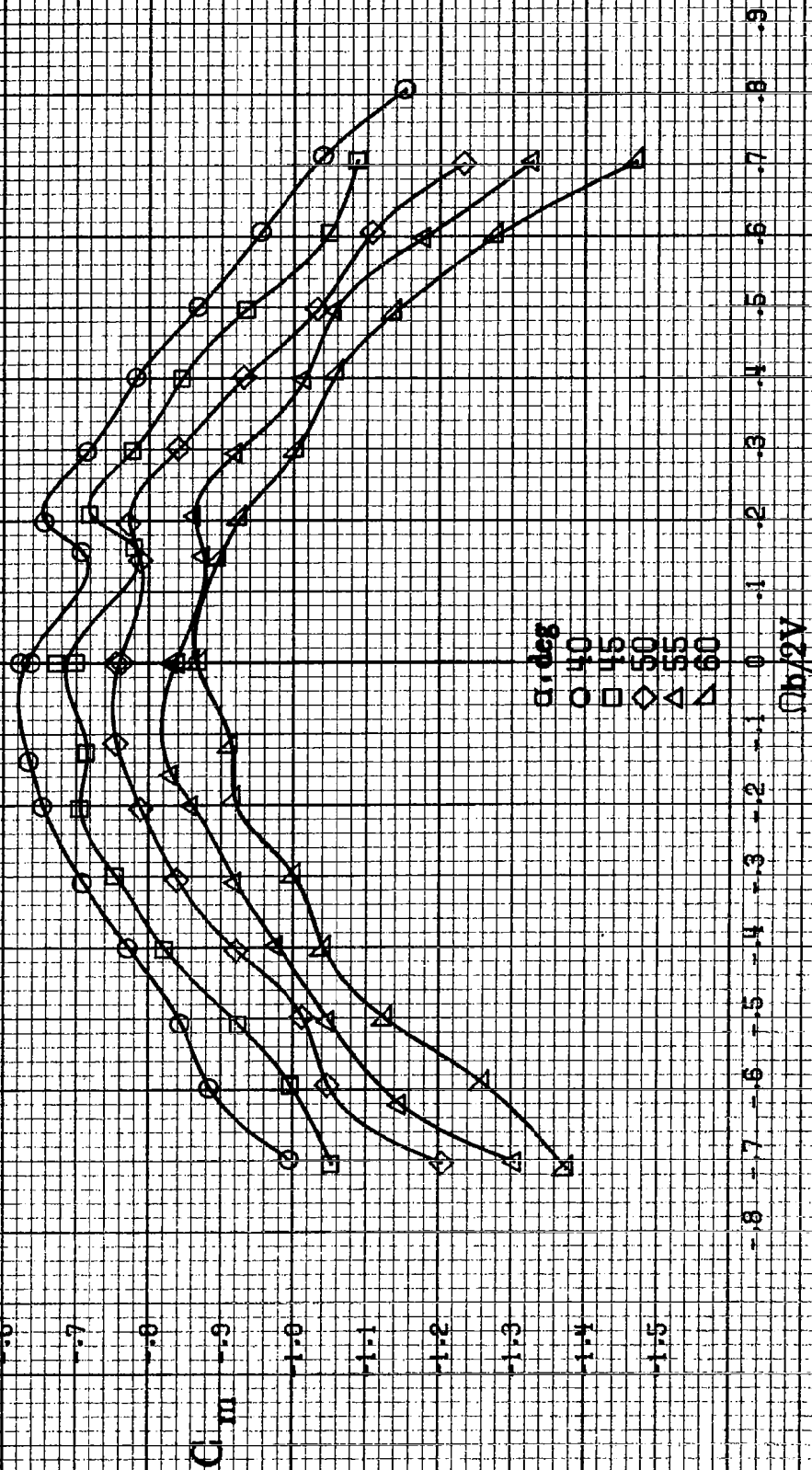
(c)  $U = 81016 \text{ deg}$ ,  $SR = 91.4 \text{ cm (36 in)}$ .

Figure A3. Continued.



(d)  $\alpha = 18$  to  $35^\circ$ ,  $SR = 91.4 \text{ cm (86 in)}$ .

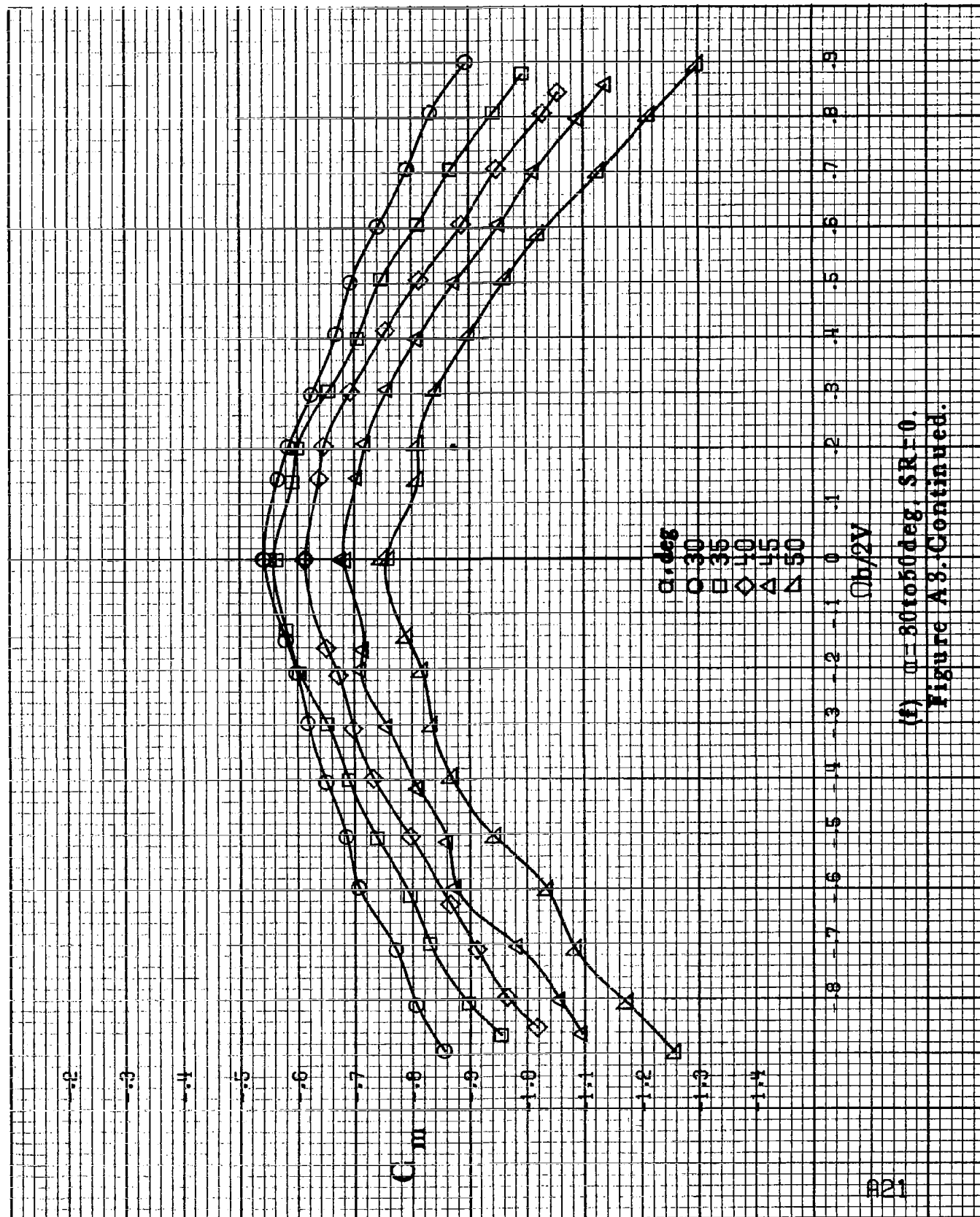
Figure A3-Continued.



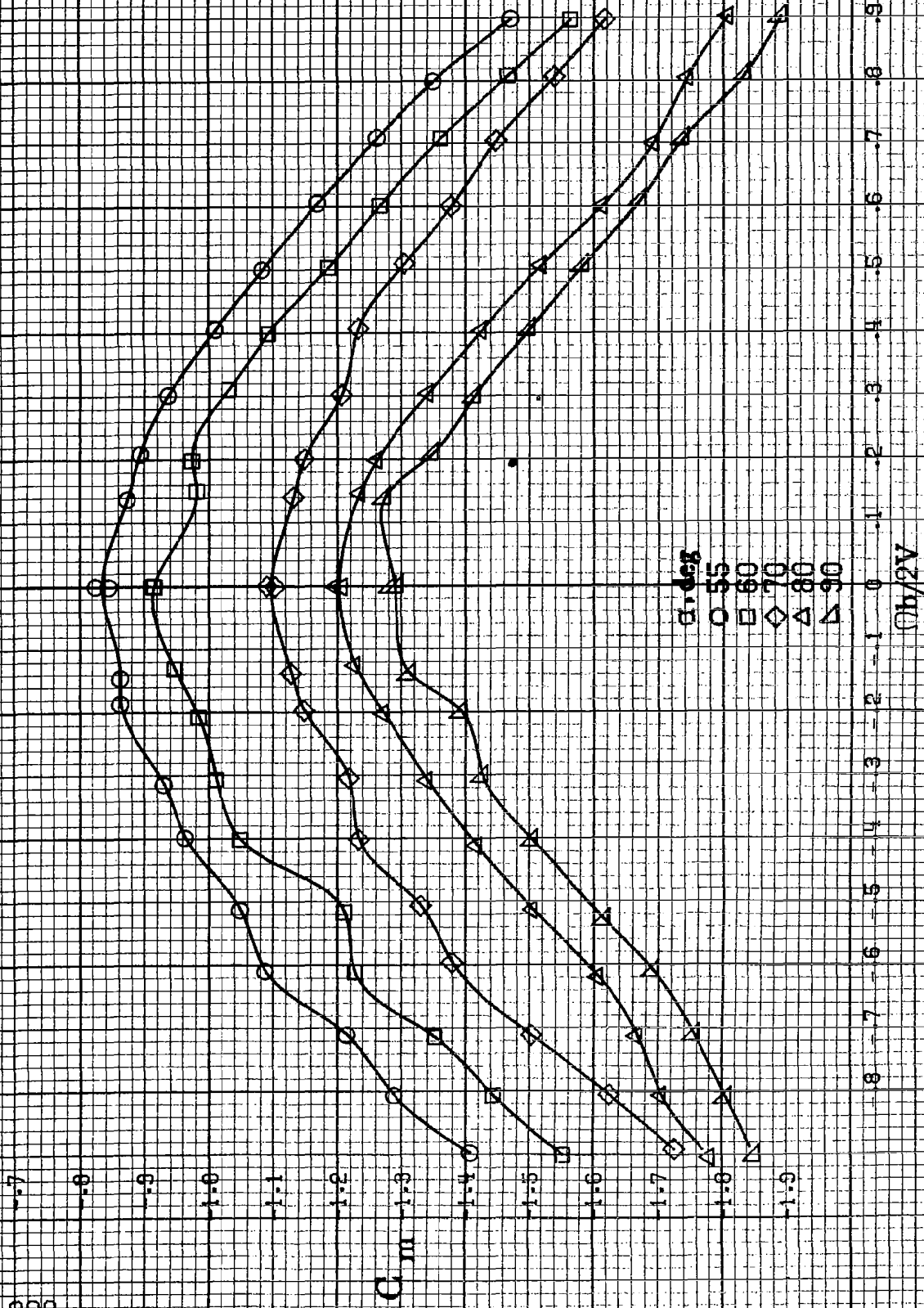
(e)  $\alpha = 40$  to  $60$  deg,  $SR = 91.4$  cm (36 in.).

Figure A8. Continued.





(f)  $\alpha = 30$  to  $50^\circ$ ,  $SR = 0$ .  
Figure A8. Continued.



(g)  $\alpha = 55$  to  $90^\circ$ ,  $SR = 0$ .

Figure A 3. Concluded.

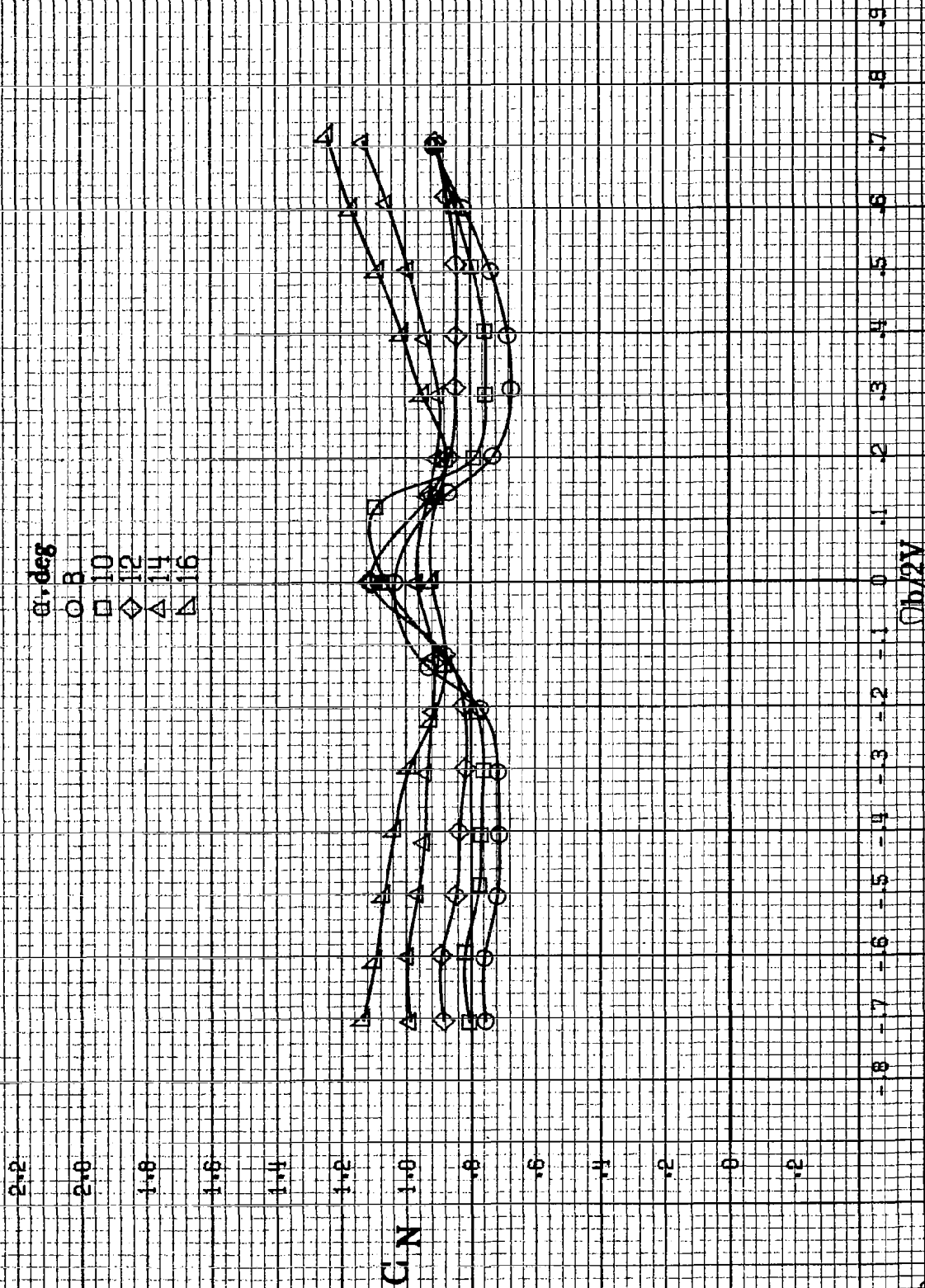
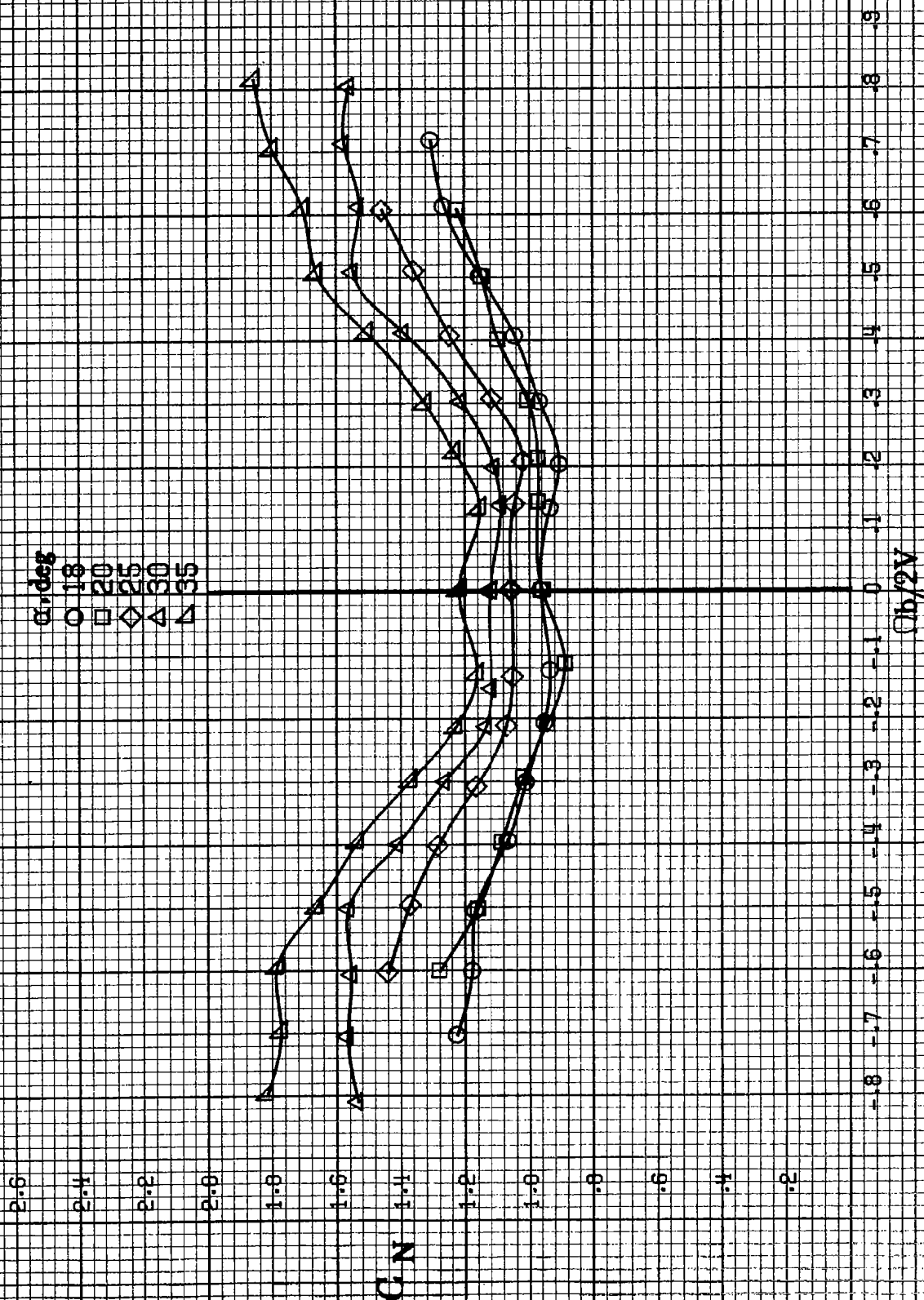
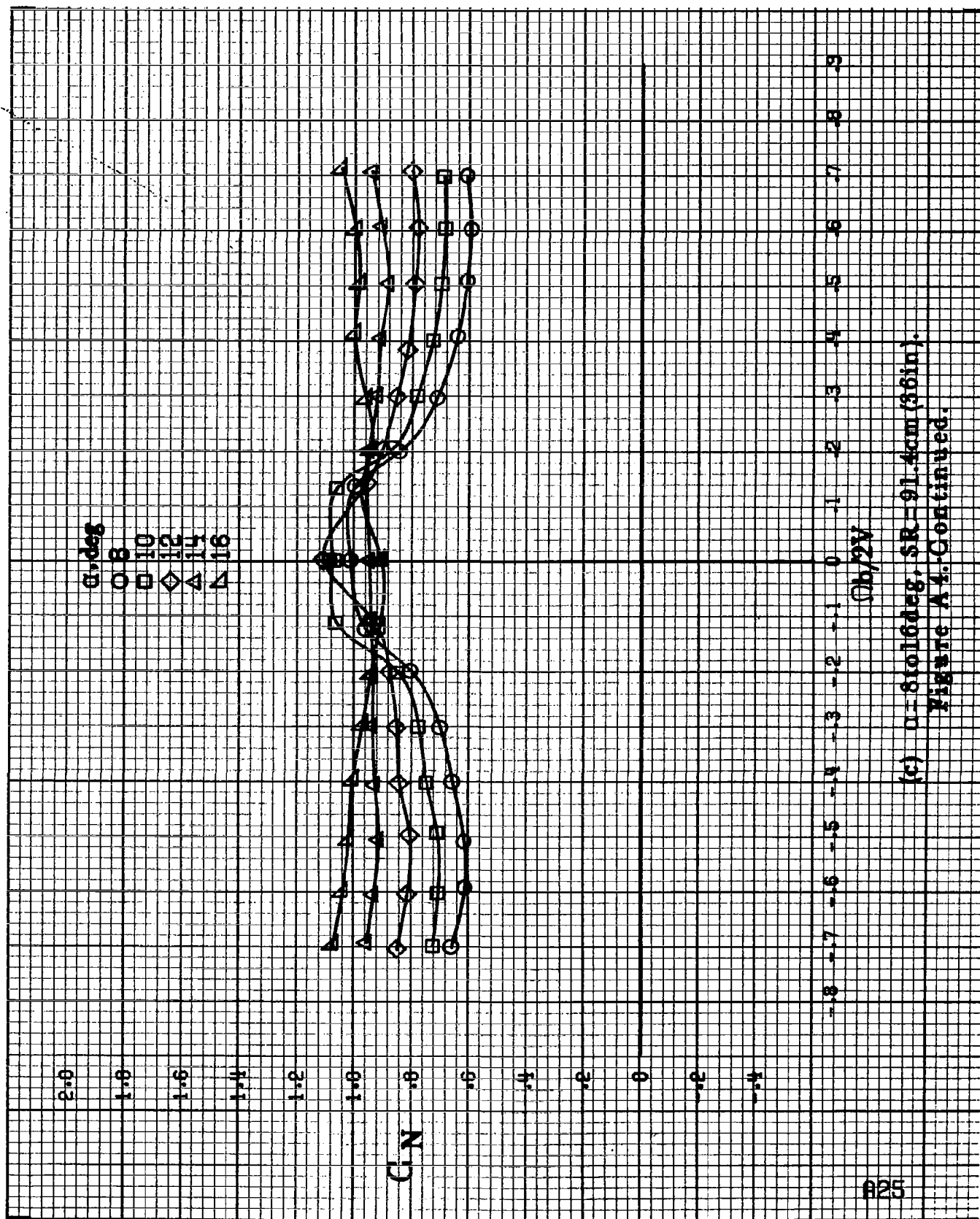


Figure A4. Effect of rotation rate and angle of attack on normal force coefficient for basic configuration.  $\delta = 0^\circ$ ,  $\delta r = 0^\circ$ ,  $\delta = 0^\circ$ .



(b)  $\alpha = 18$  to  $35$  deg,  $SR = 182.9$  cm (72 in).

Figure A4. Continued.



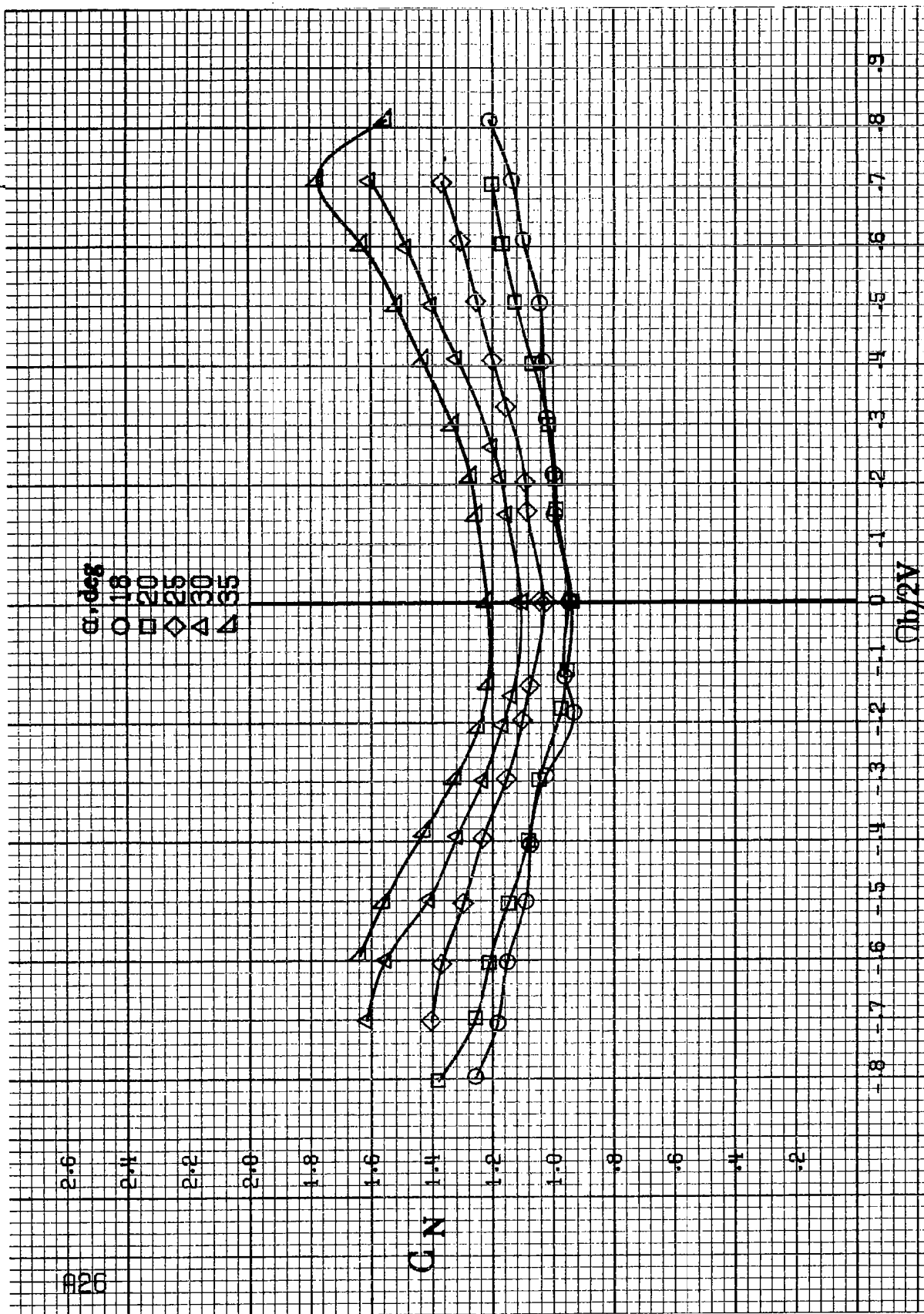
(c)  $\alpha = 8$  to  $16^\circ$ ,  $SR = 91.4 \text{ cm (36 in.)}$ .  
Figure A4. Continued.

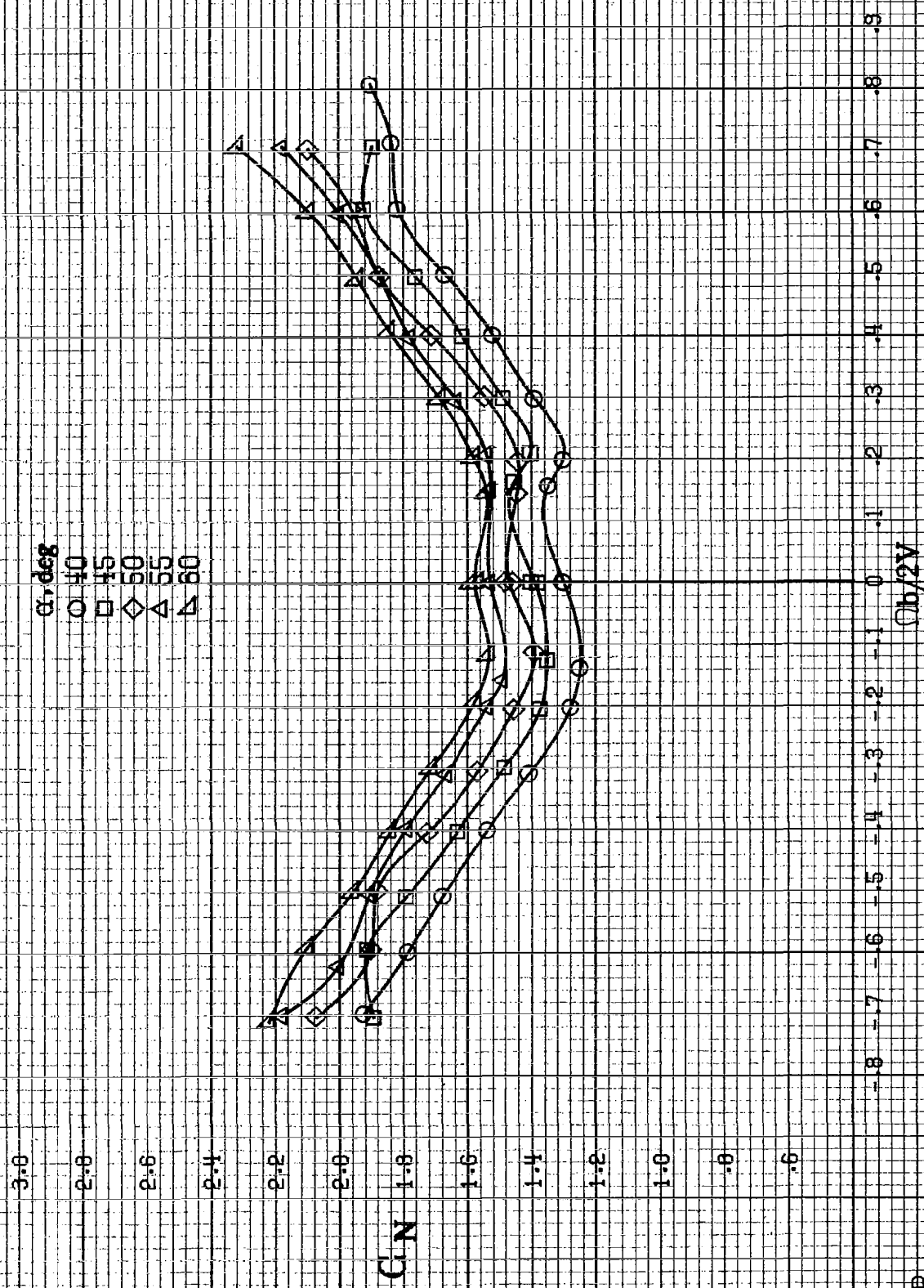
$\alpha, \text{deg}$   
 ○ 18  
 □ 20  
 ◇ 25  
 △ 30  
 ▲ 35

C/N

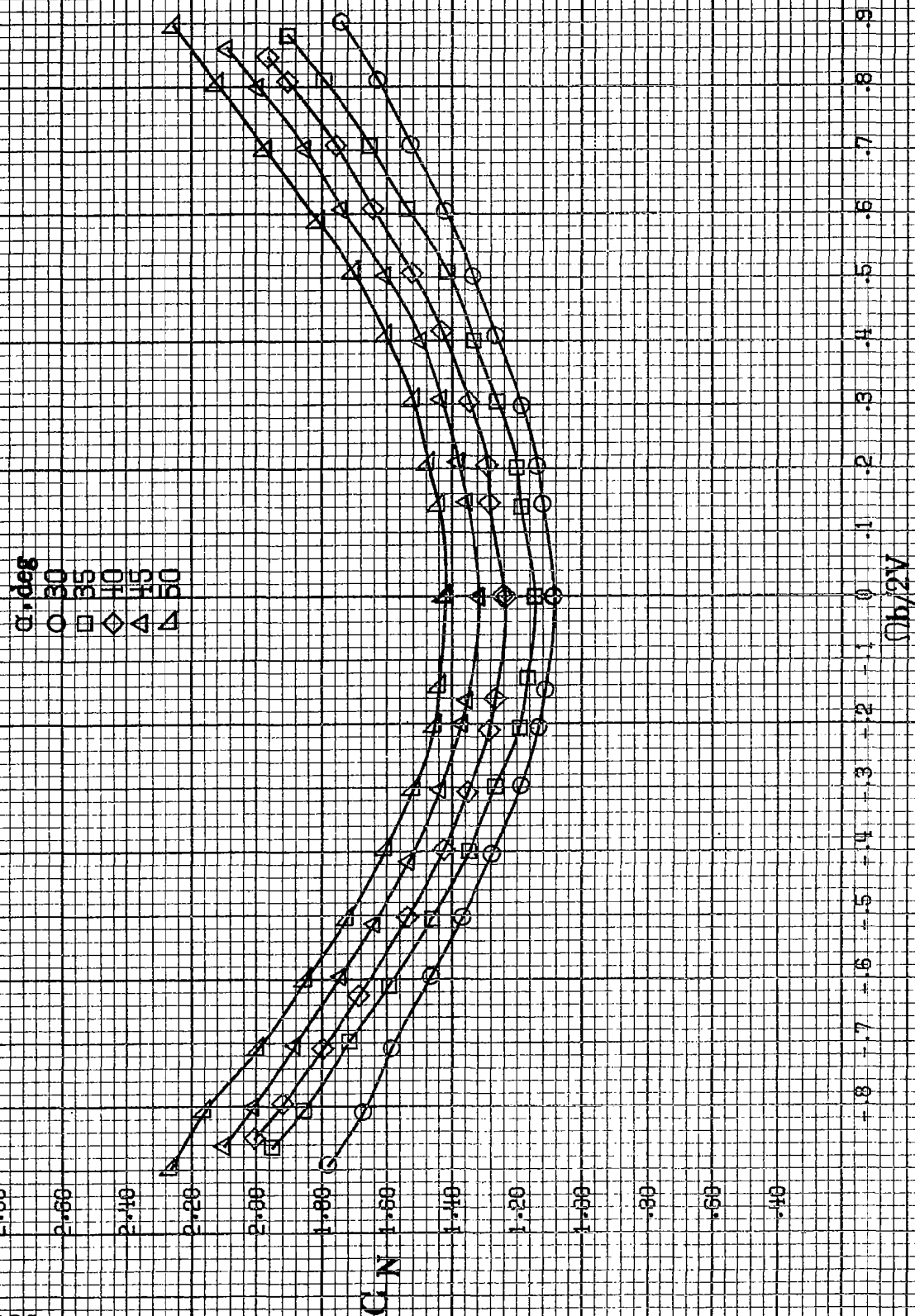
$\Omega_b/2V$

(d)  $\alpha=18$  to  $35$  deg,  $SR=91.4 \text{ cm (36 in.)}$ .  
 Figure A4.-Continued.





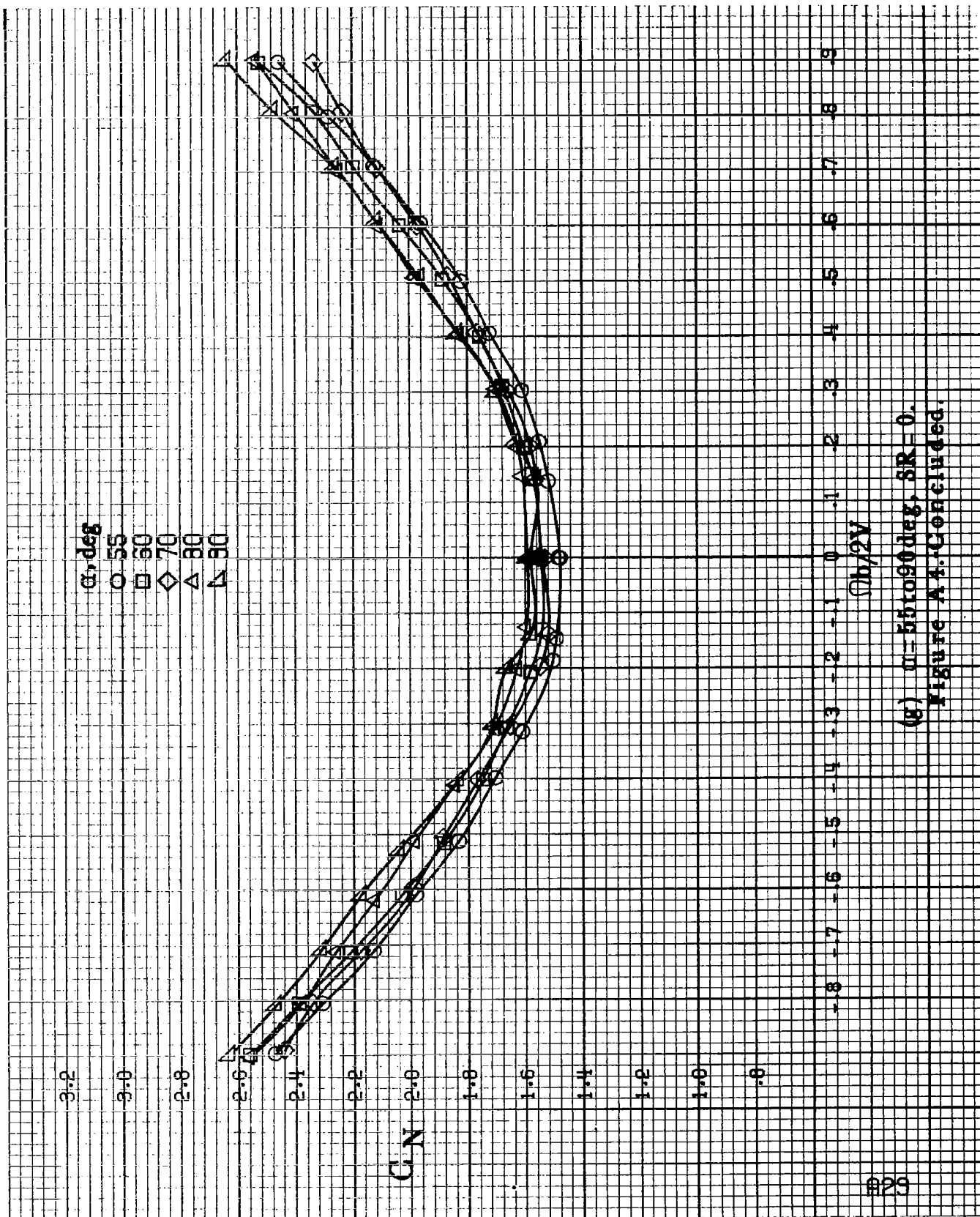
(e)  $\alpha = 40$  to  $60^\circ$ , SR-91.4cm (36in).  
Figure A4. Continued.



(f)  $\alpha = 30$  to  $50^\circ$ ,  $SR = 0$ .

Figure A 4-Continued.





(g)  $\alpha = 55$  to  $90$  deg,  $SR = 0$ .  
 Figure A4. Continued.

$\alpha, \text{deg}$ 

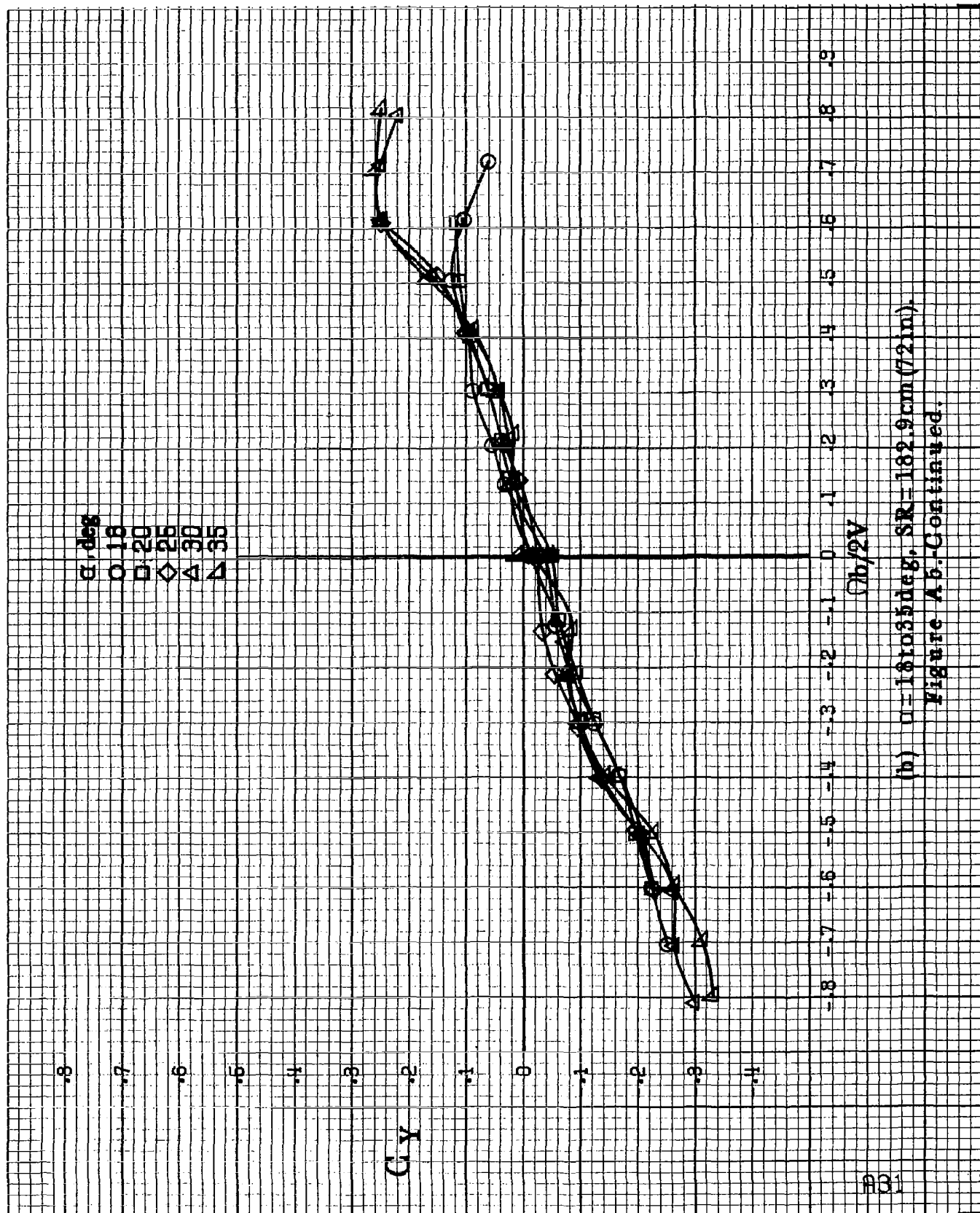
$\circ$  8  
 $\square$  10  
 $\triangle$  12  
 $\diamond$  14  
 $\nabla$  16

 $C_y$ 

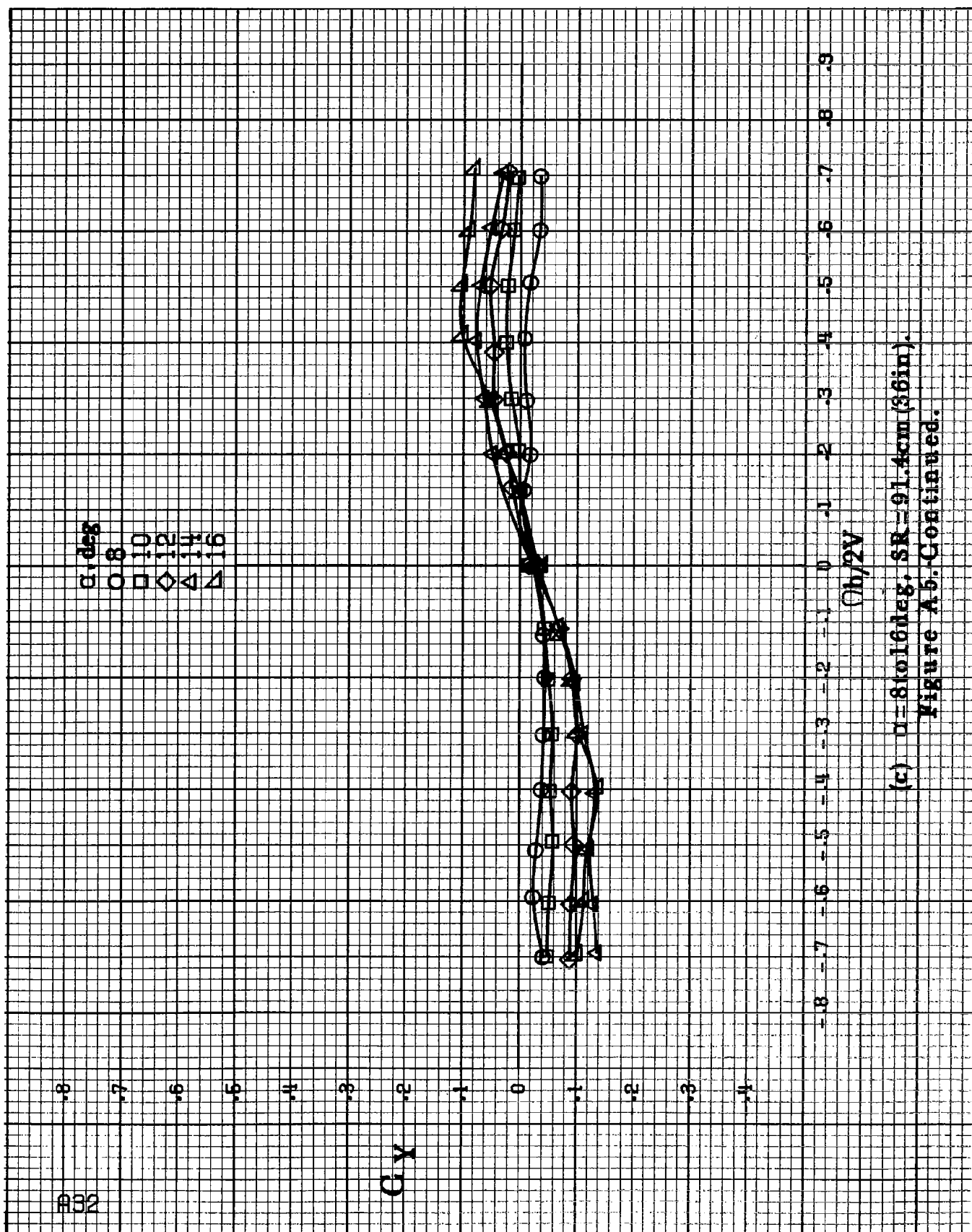

(a)  $\alpha = 8$  to  $16 \text{ deg}$ ,  $SR = 182.9 \text{ cm (7.2 in)}$ .

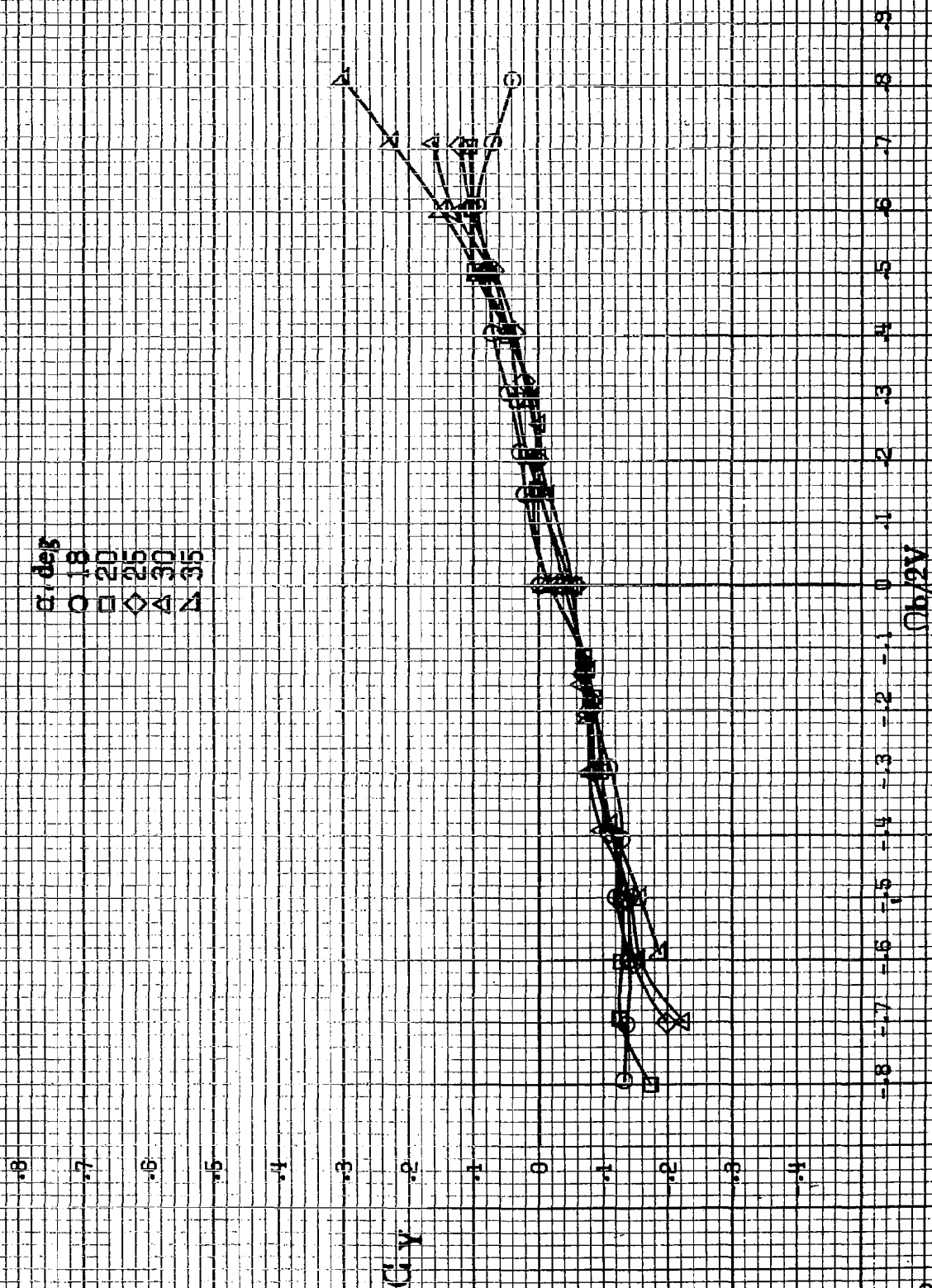
(b)  $2V$

Figure 8b. Effect of rotation rate and angle of attack on side-force coefficient for basic configuration.  $\delta = 0^\circ$ ,  $\delta = -0^\circ$ ,  $\delta = 0^\circ$ ,  $\delta = 0^\circ$ .



(b)  $u=181035\text{deg}$ ,  $SR=182.9\text{cm}(72\text{in})$ .  
Figure A5-Continued.





(d)  $\alpha = 18$  to  $35$  deg, SR =  $91.4$  cm (36 in).  
 Figure A5-Continued.

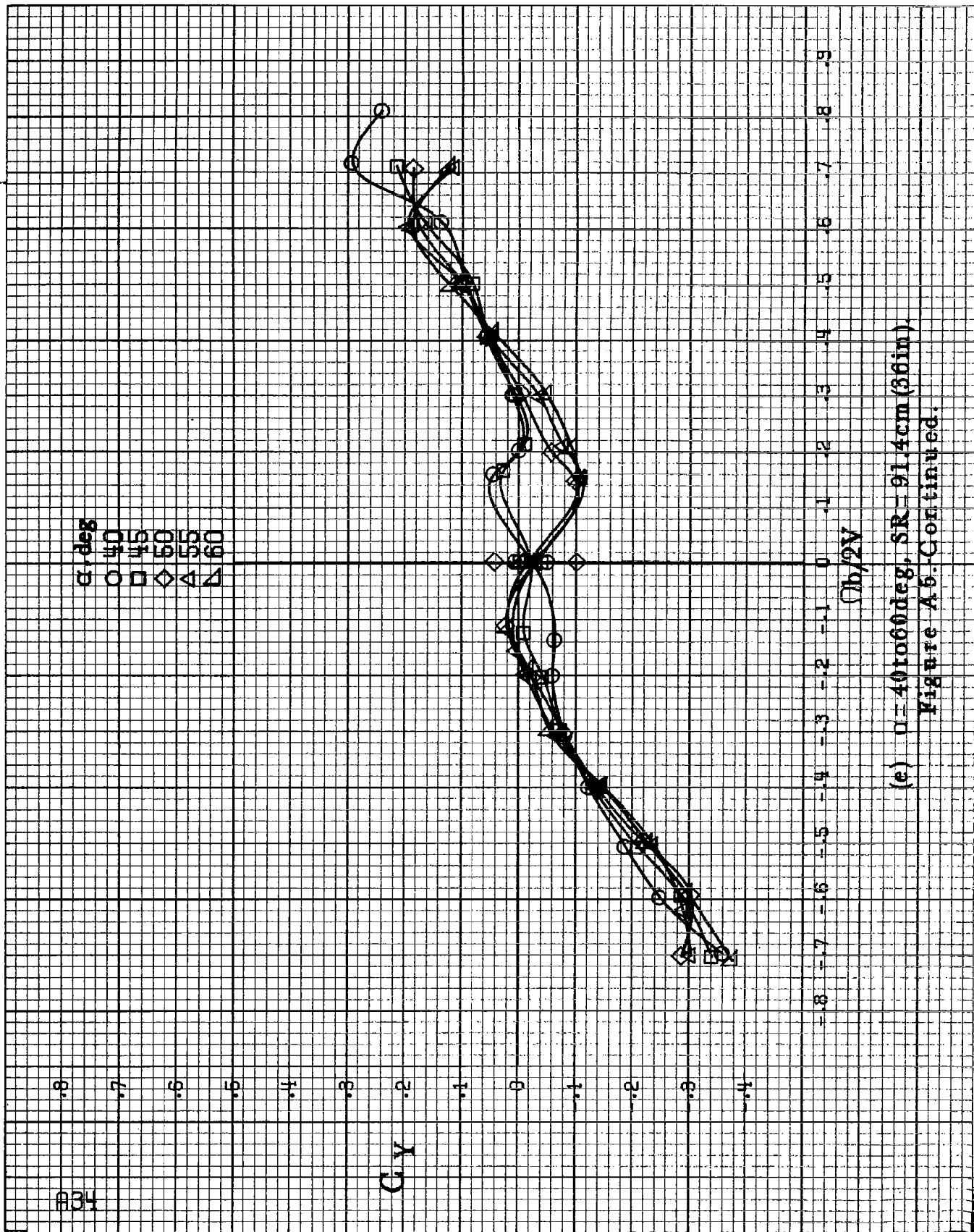
$\alpha$ , deg  
 ○ 40  
 □ 45  
 ◇ 50  
 △ 55  
 ▽ 60

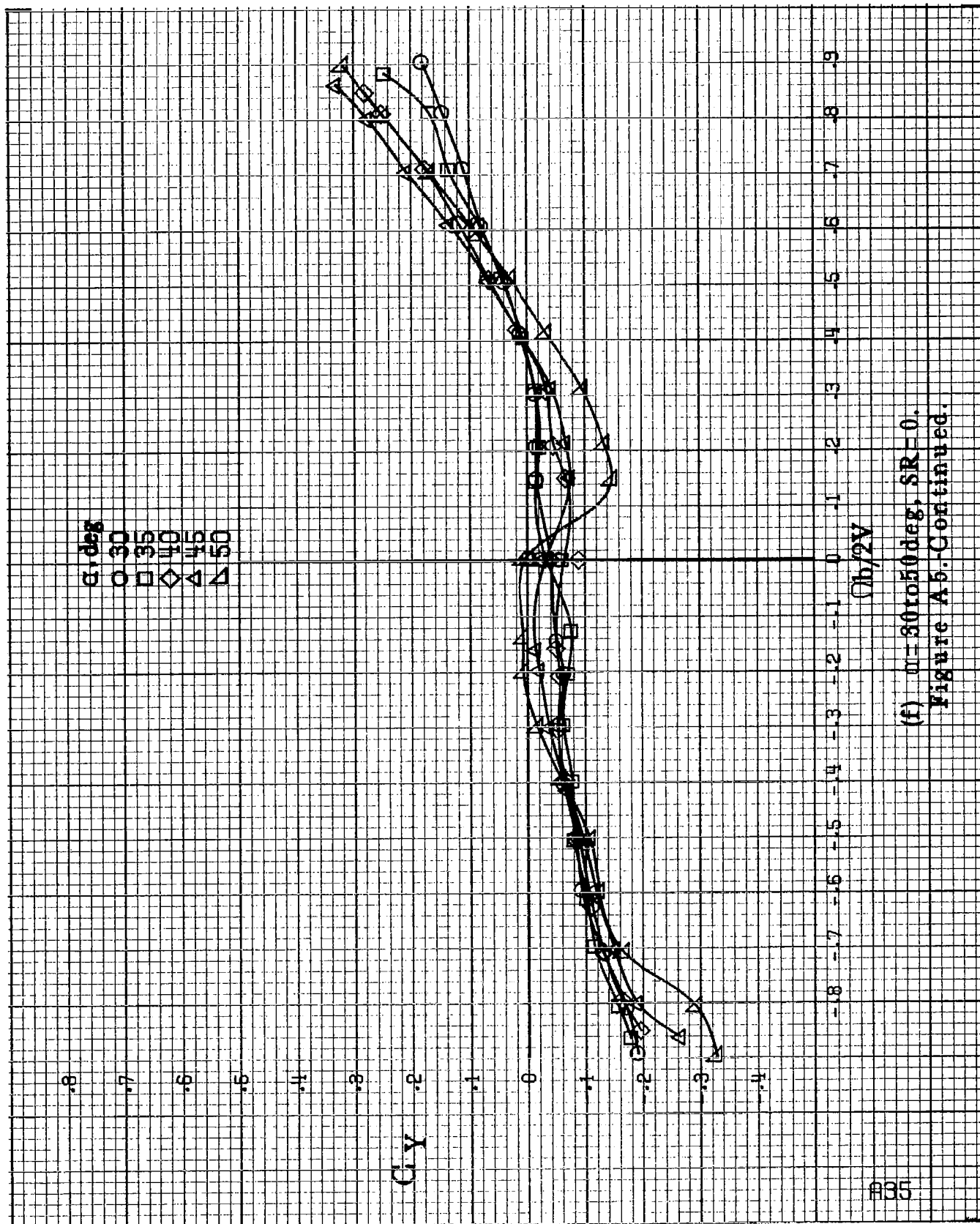
$C_y$

$(h/2V)$

(e)  $\alpha = 40$  to  $60$  deg,  $SR = 91.4$  cm (36 in).

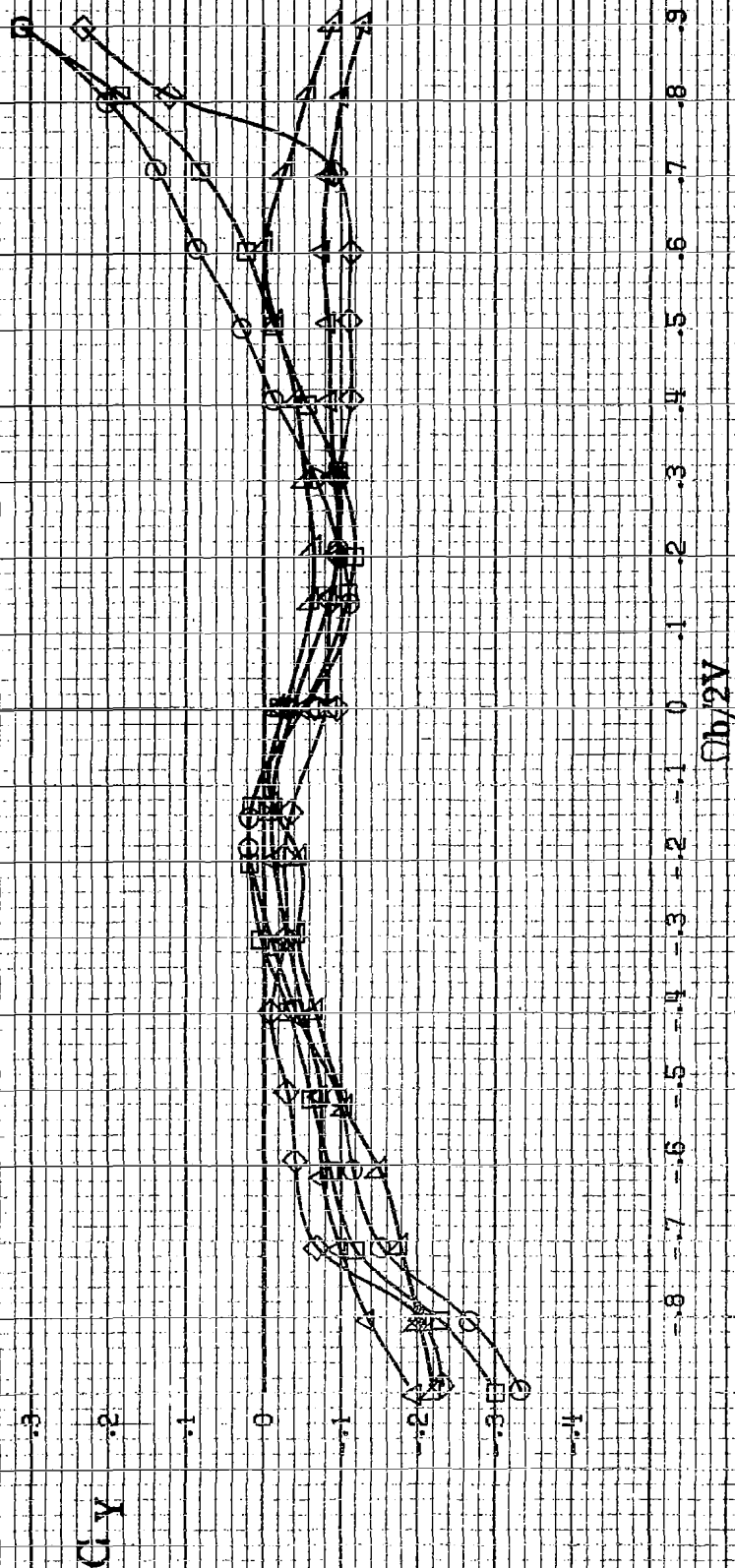
Figure A5. Continued.





(f)  $\alpha=30$  to  $50$  deg,  $SR=0$ .  
Figure A5-Continued.

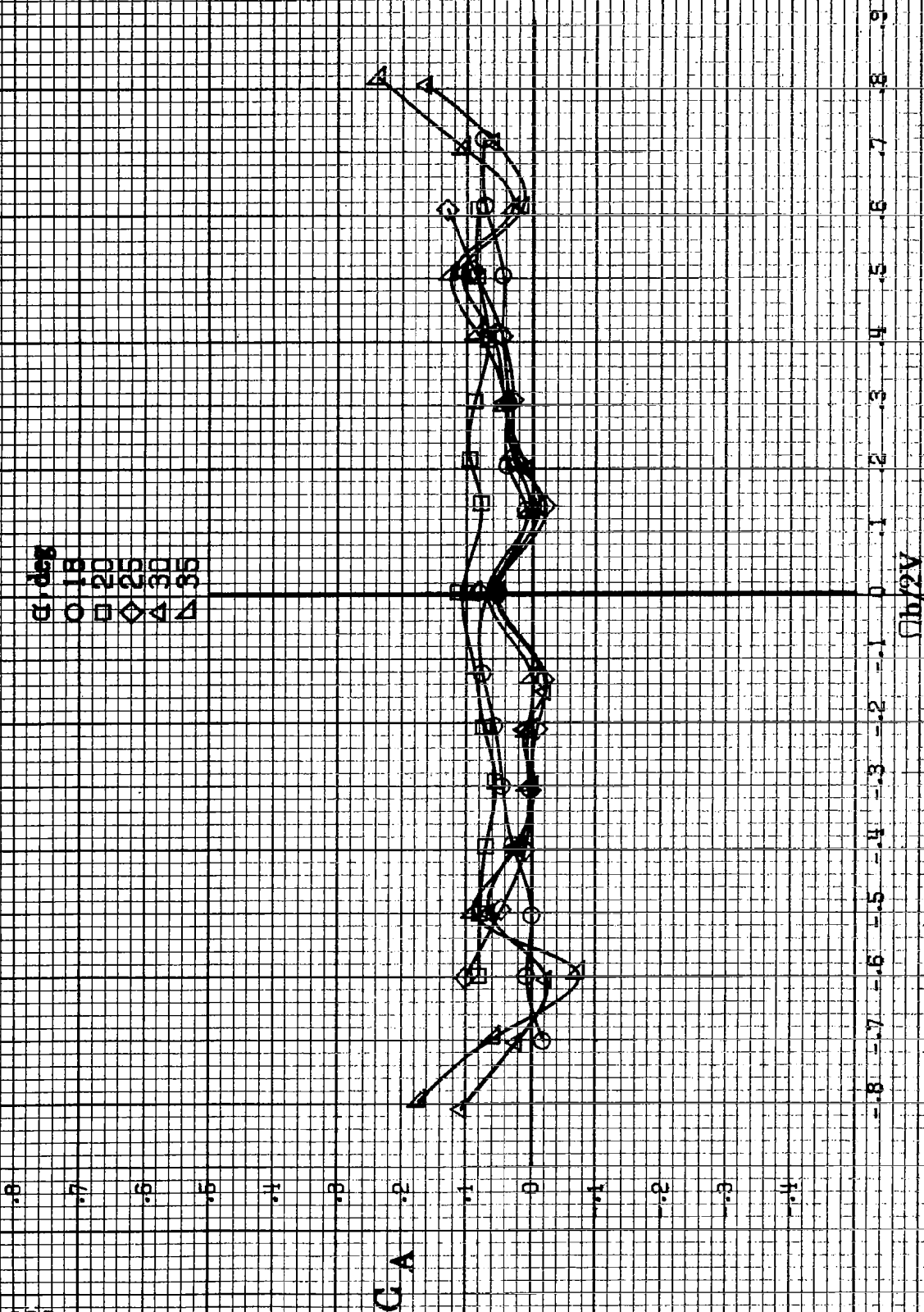
$\alpha, \text{deg}$   
 ○ 55  
 □ 60  
 ◇ 70  
 △ 80  
 ▽ 90



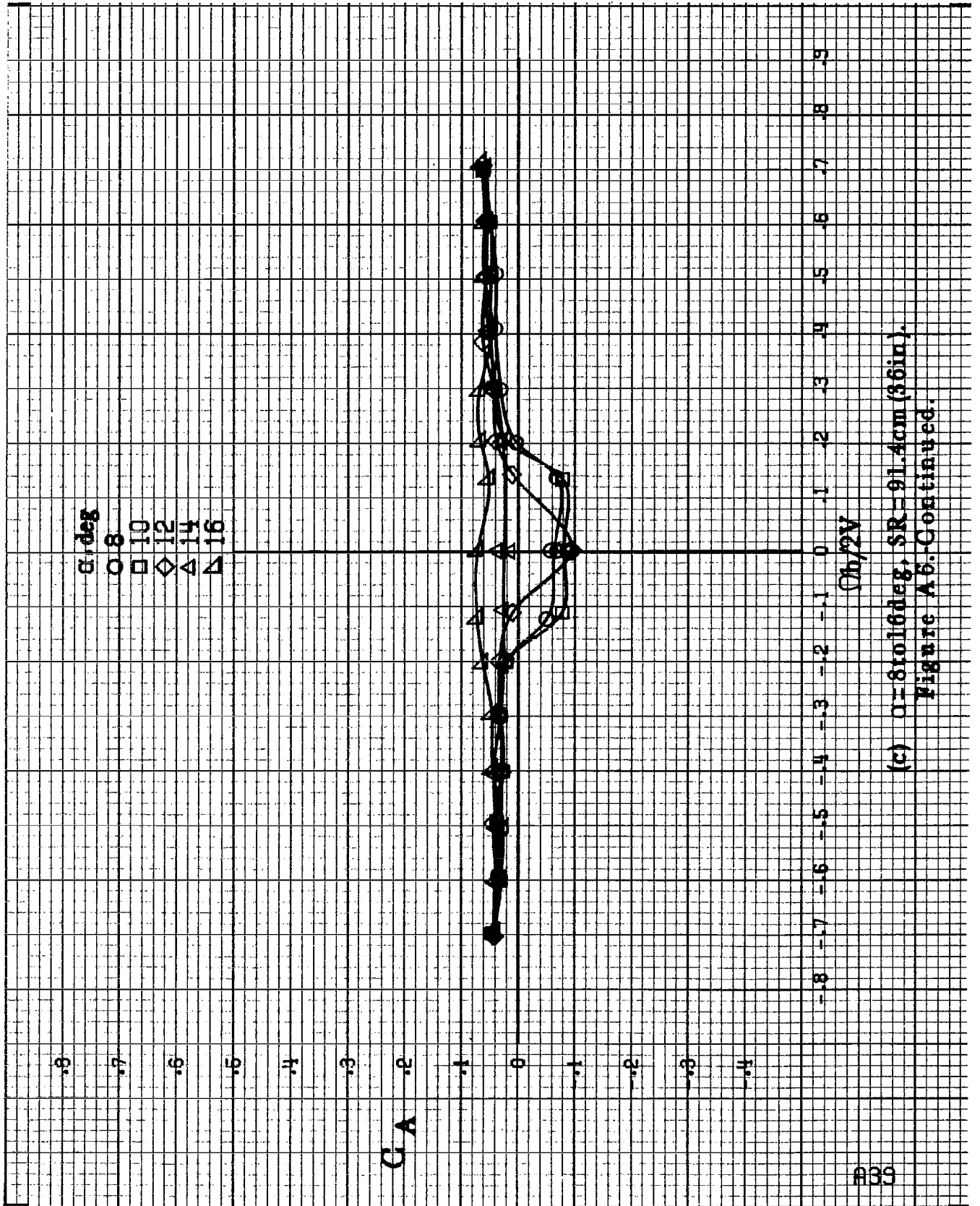
(g)  $\alpha = 55$  to  $90$  deg,  $SR = 0$ .  
 Figure A5. Concluded.







(b)  $\Gamma = 1.8$  to  $3.5$  deg,  $SR = 1.82$  to  $9.0$  cm (72 in.)  
Figure A6. Continued.



(c)  $\alpha = 8$  to  $16^\circ$ ,  $SR = 91.4 \text{ cm (36 in.)}$ .  
Figure A6-Continued.

840

.8

.7

.6

.5

.4

.3

.2

.1

0

-.1

-.2

-.3

-.4

-.5

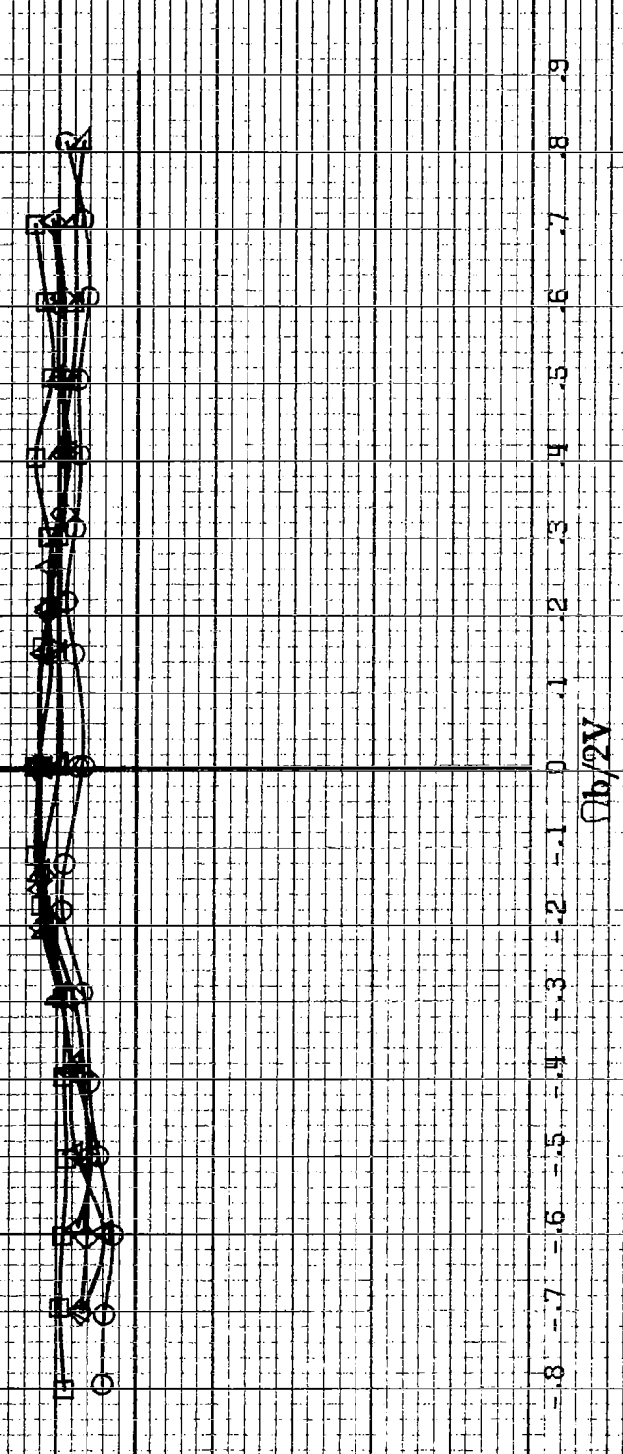
-.6

-.7

-.8

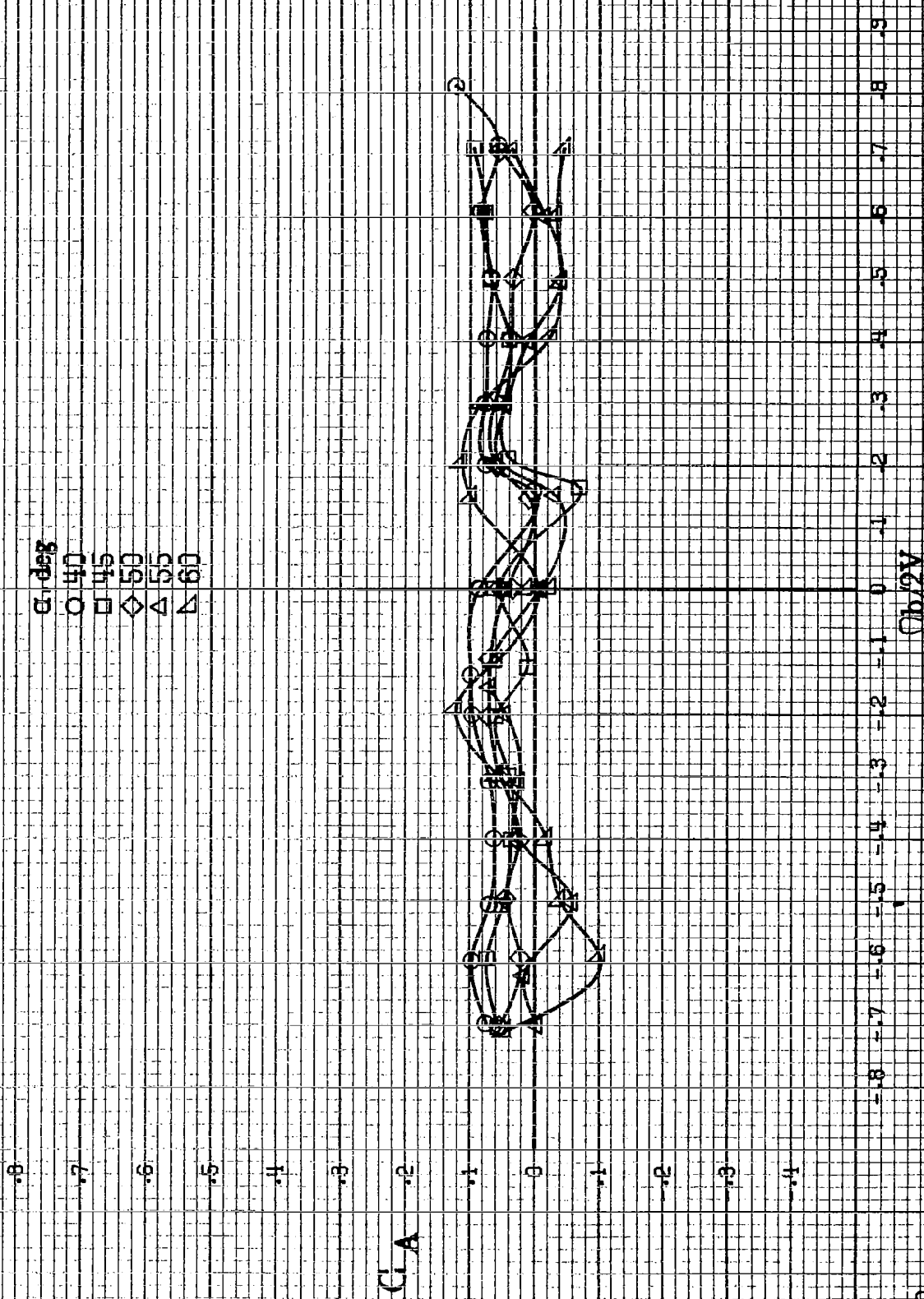
C.A

$\alpha$ , deg  
 ○ 18  
 □ 20  
 ◇ 25  
 △ 30  
 ▽ 35



(d)  $\alpha=18$  to  $35^\circ$ , SR=91.4cm (36in).

Figure A6-Continued.



(e)  $0 \pm 40$  to  $60$  deg,  $SR = 91.4 \text{ cm (36 in.)}$ .  
 Figure A6: Continued.

942

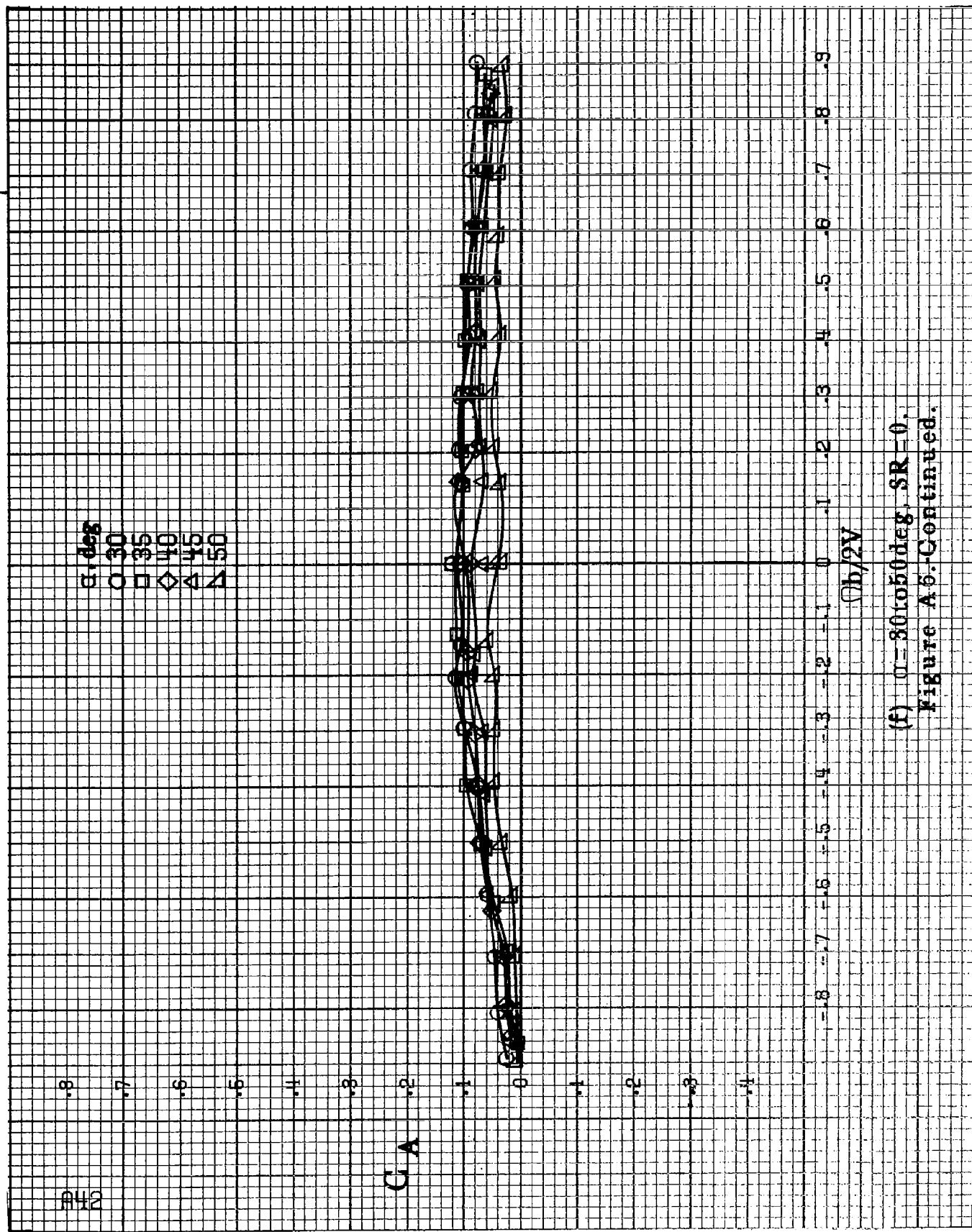
$\alpha$ , deg

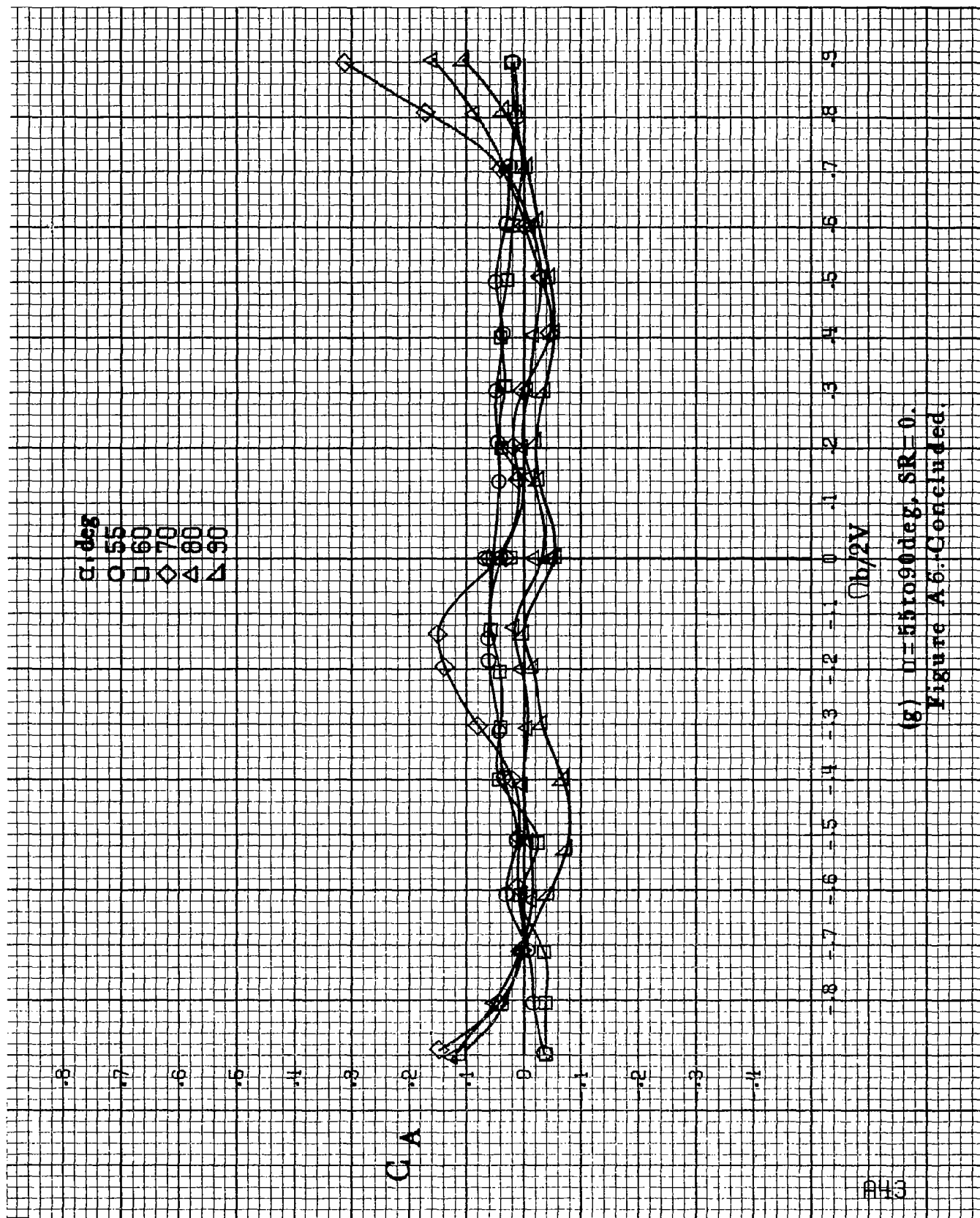
○ 30  
□ 35  
◇ 40  
△ 45  
▽ 50

$C_A$

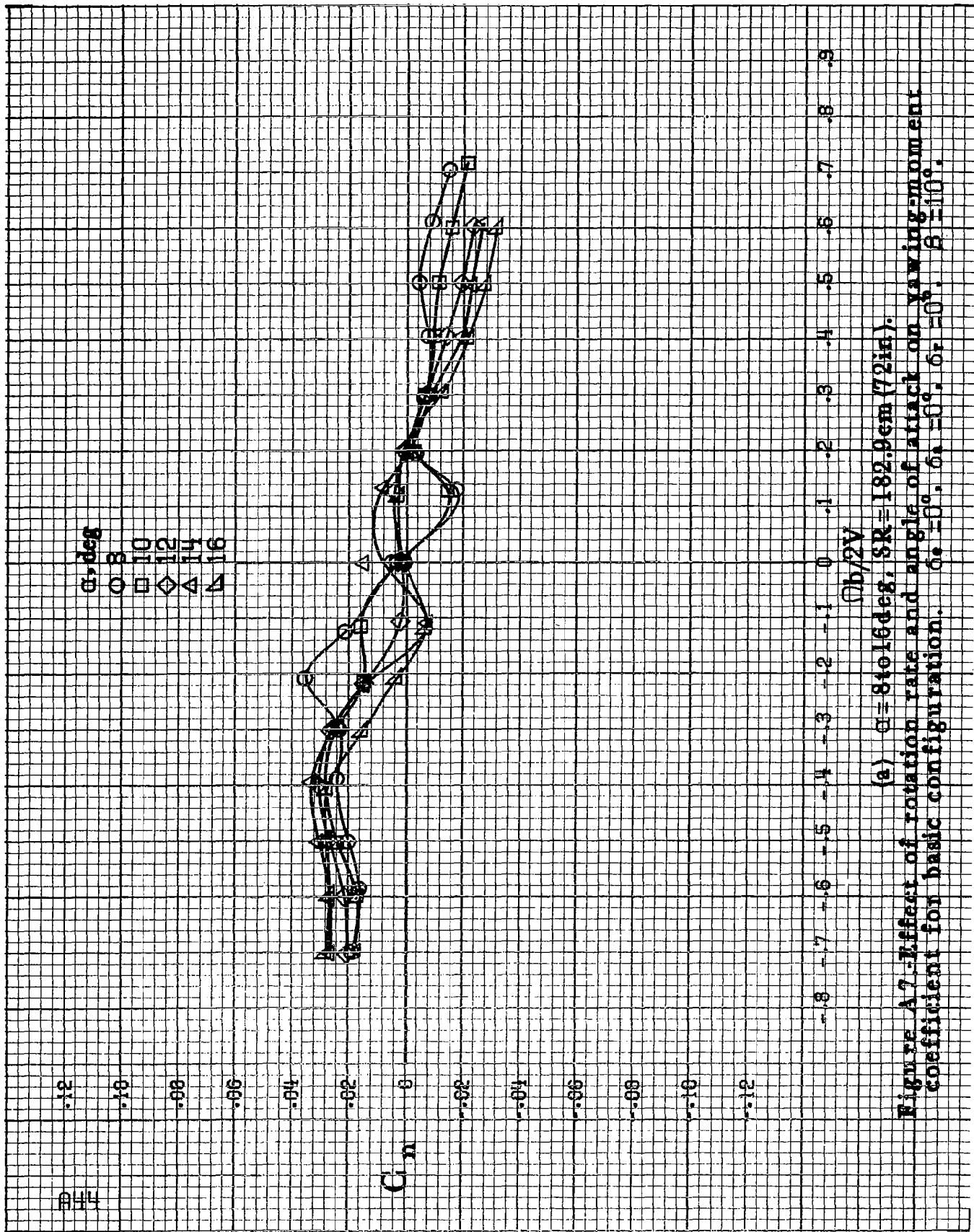
$\phi_b/2V$

(f)  $\alpha = 30$  to  $50$  deg,  $SR = 0$ .  
Figure A 5.-Continued.





(g)  $\alpha = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A6-Concluded.



(a)  $\alpha = 8$  to  $16^\circ$ ,  $SR = 182.9$  cm (72 in).

Figure A7-Effect of rotation rate and angle of attack on yawing-moment coefficient for basic configuration.  $\delta_a = 0^\circ$ ,  $\delta_r = 0^\circ$ ,  $\delta = 10^\circ$ .



$\alpha$ , deg  
 ○ 18  
 □ 20  
 ◇ 25  
 △ 30  
 ▽ 35

0.14

0.12

0.10

0.08

0.06

0.04

0.02

0

-0.02

-0.04

-0.06

-0.08

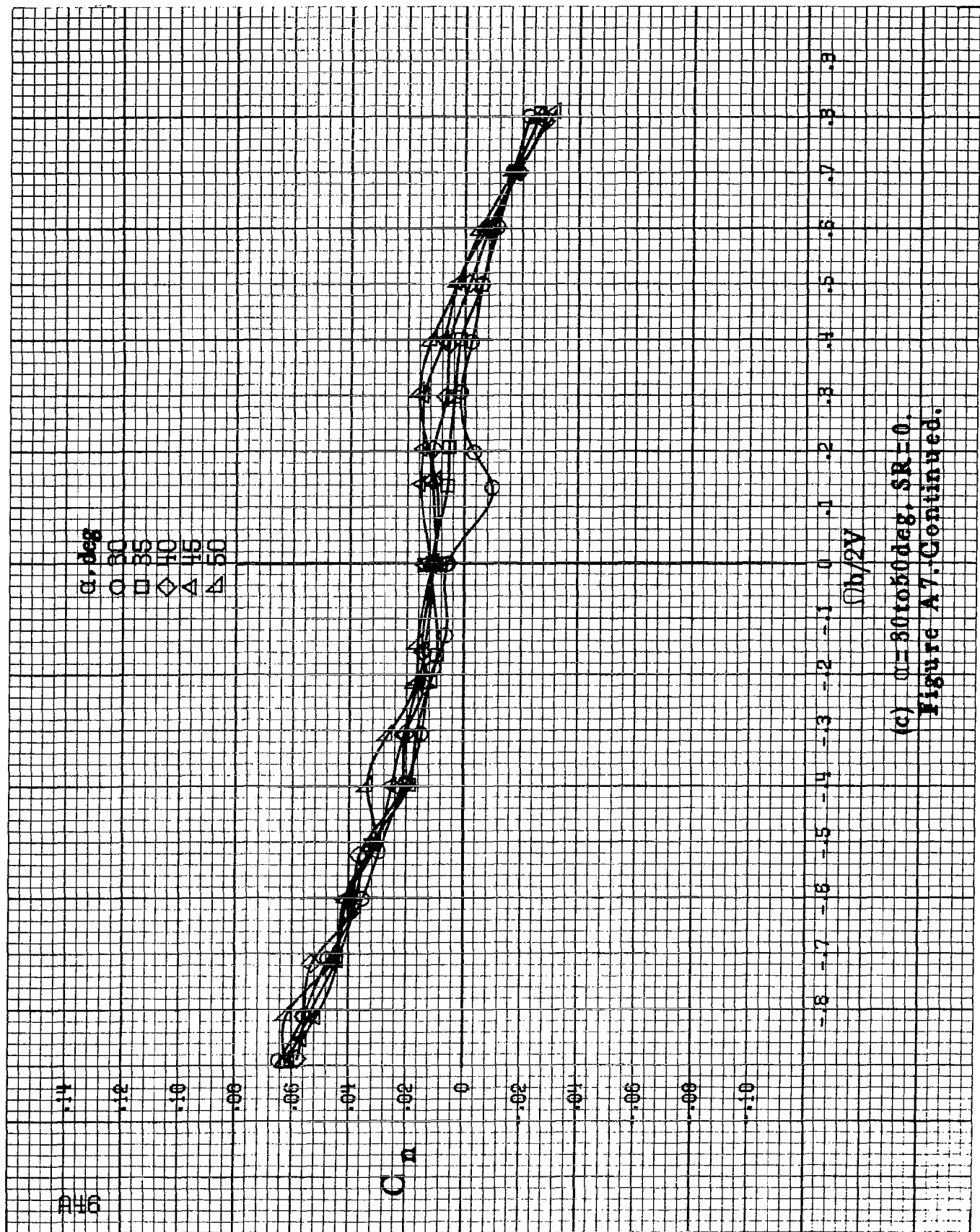
-0.10

$C_{L_n}$

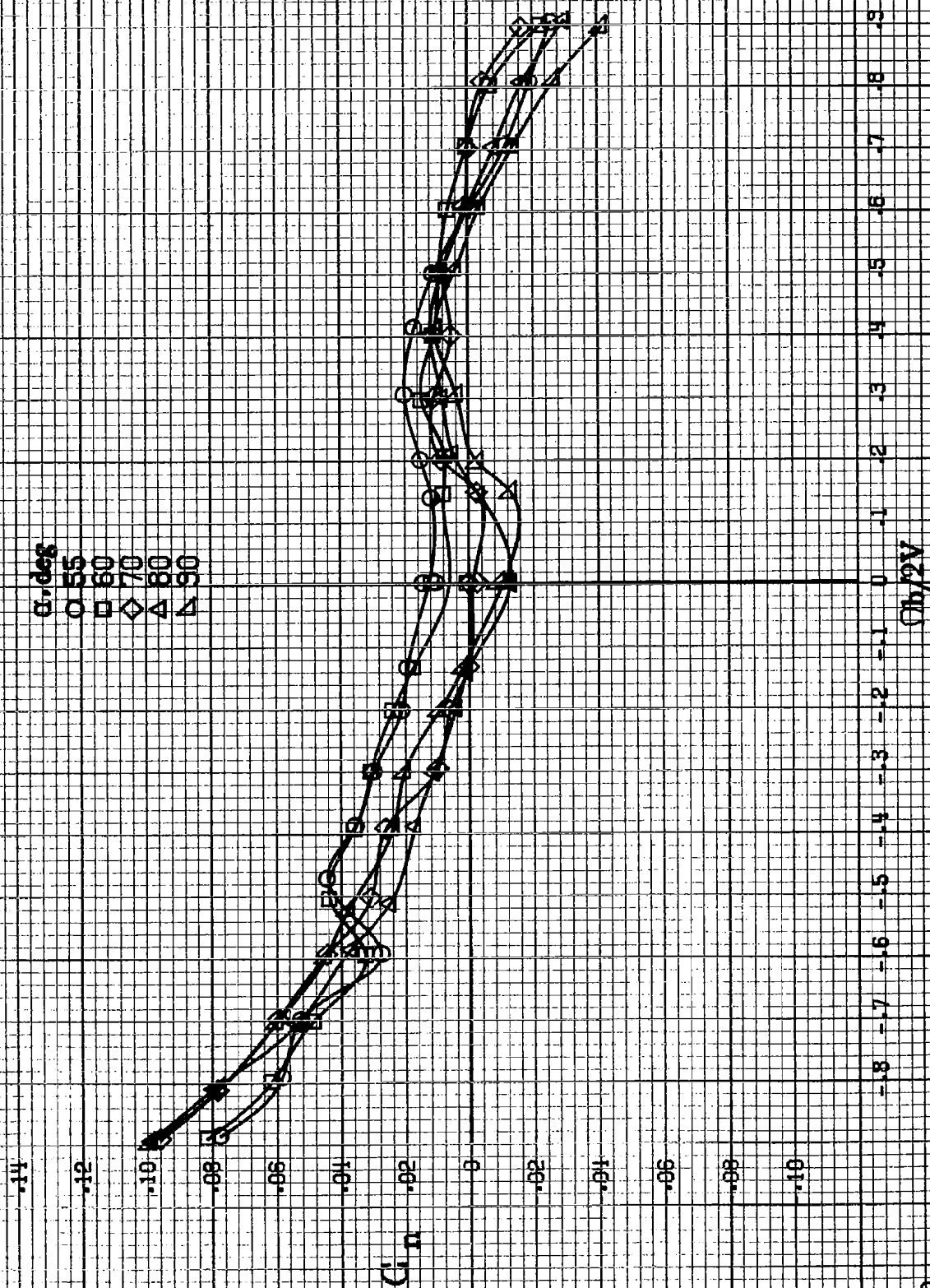
-8 -7 -6 -5 -4 -3 -2 -1 0 .1 .2 .3 .4 .5 .6 .7 .8 .9

$b/2V$

(b)  $\alpha = 18$  to  $35$  deg, SR = 182.9 cm (72 in).  
 Figure A7-Continued.



(c)  $\alpha = 30$  to  $50$  deg, SR-0.  
Figure A7-Continued.



(d)  $\alpha=55$  to  $90^\circ$ ,  $SR=0$ .  
Figure A7-Continued.

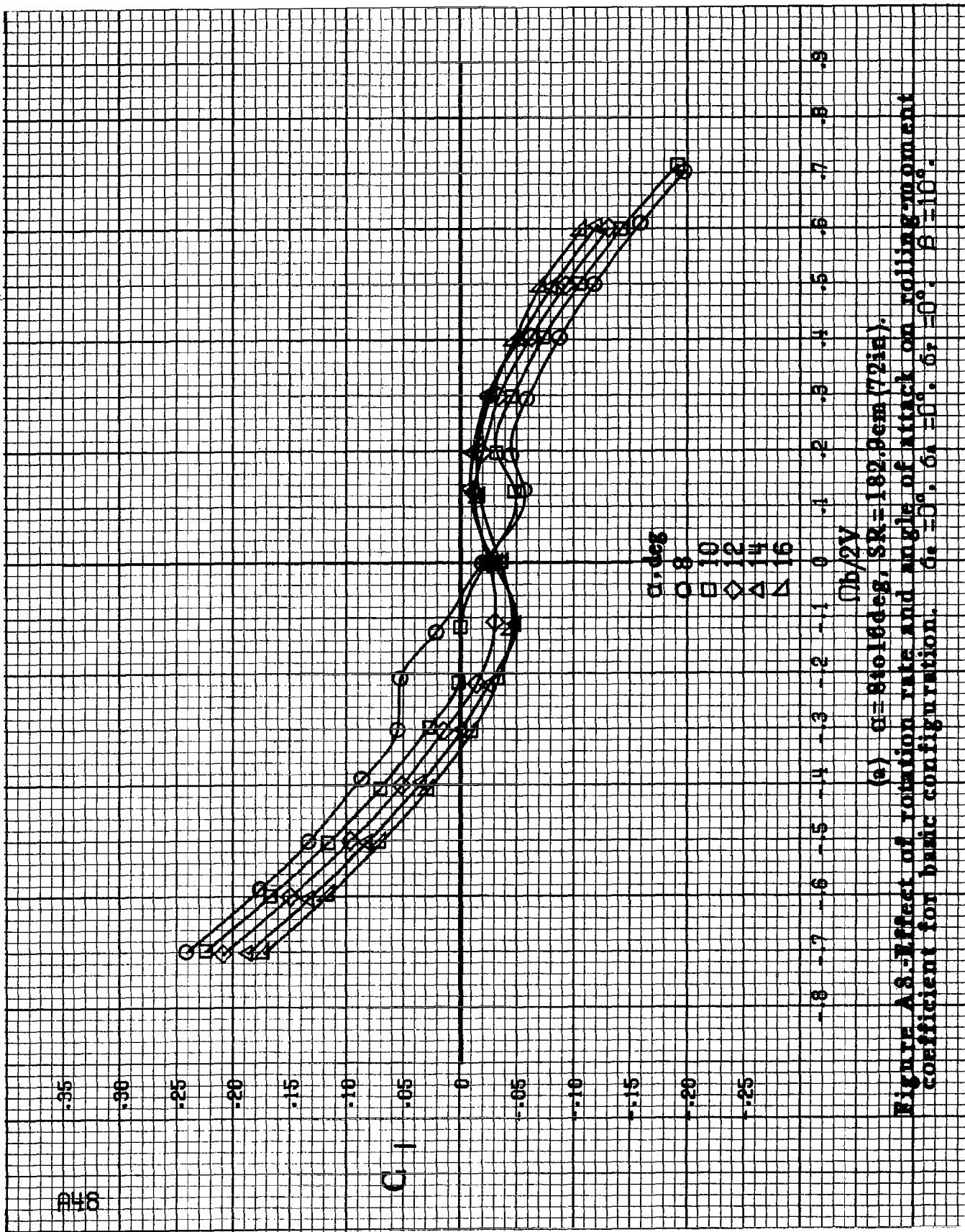
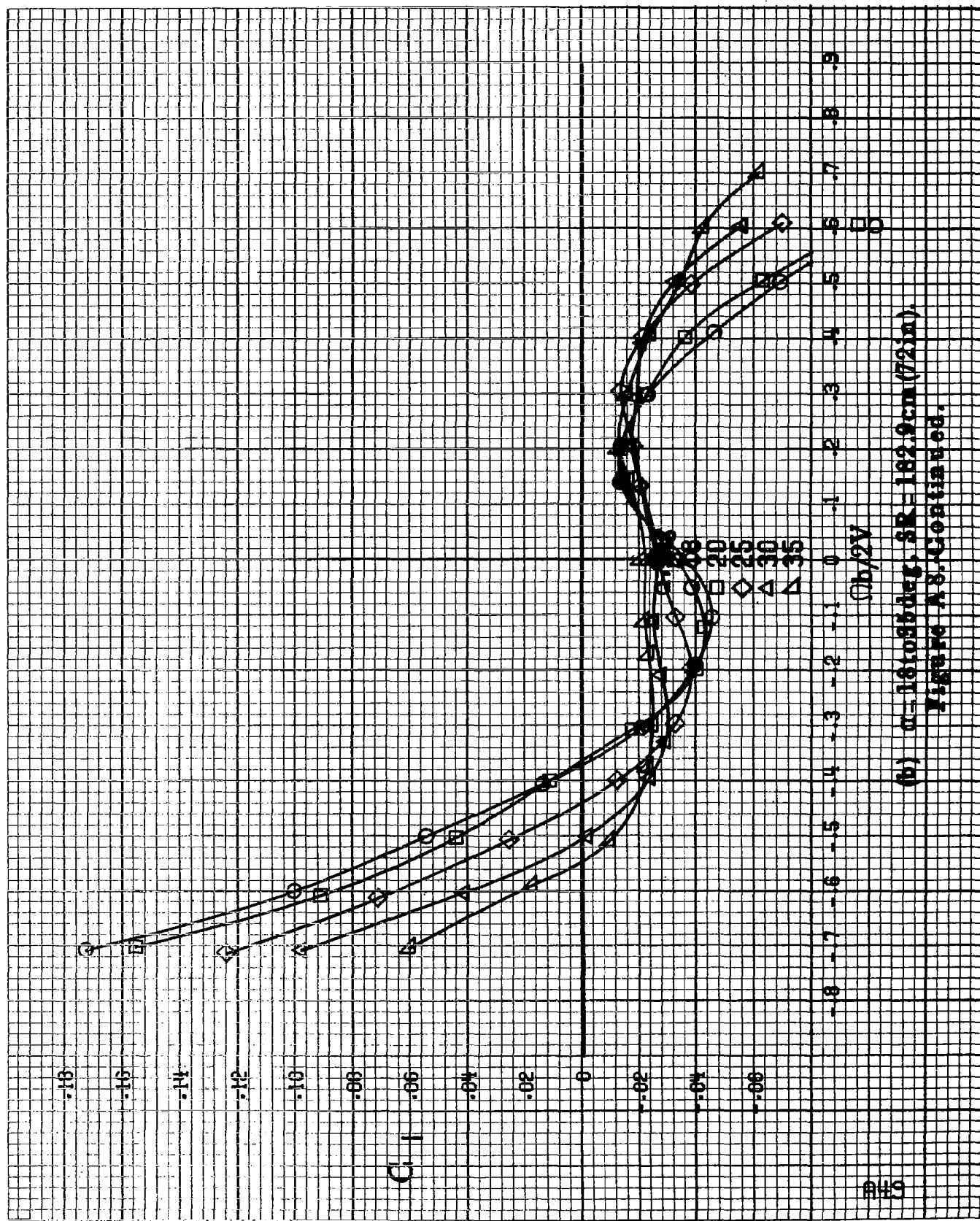
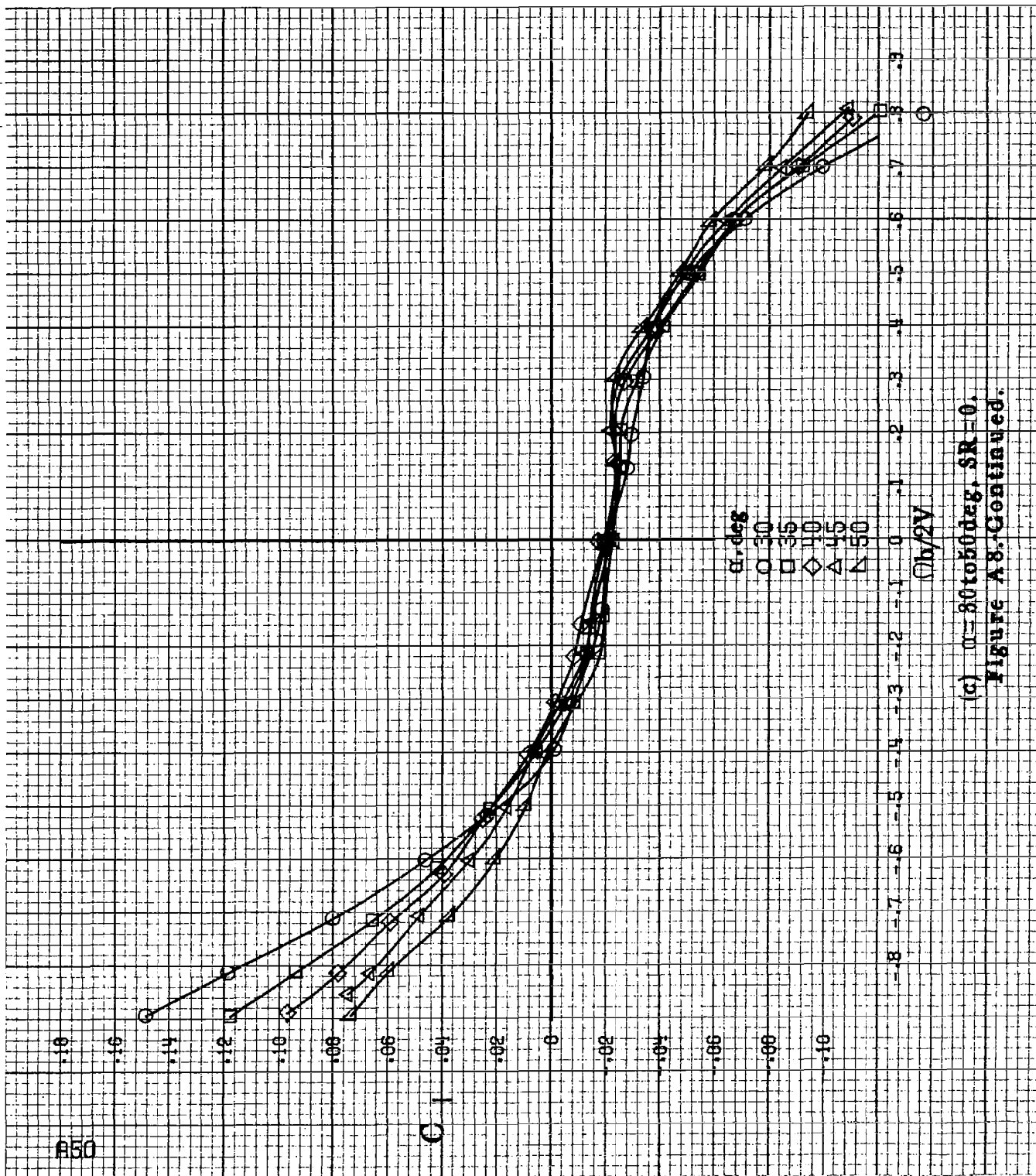


Figure A3. Effect of rotation rate and angle of attack on rolling-moment coefficient for basic configuration.  $\delta_a = 0^\circ$ ,  $\delta_h = 0^\circ$ ,  $\delta_r = 0^\circ$ ,  $\delta = 10^\circ$ .

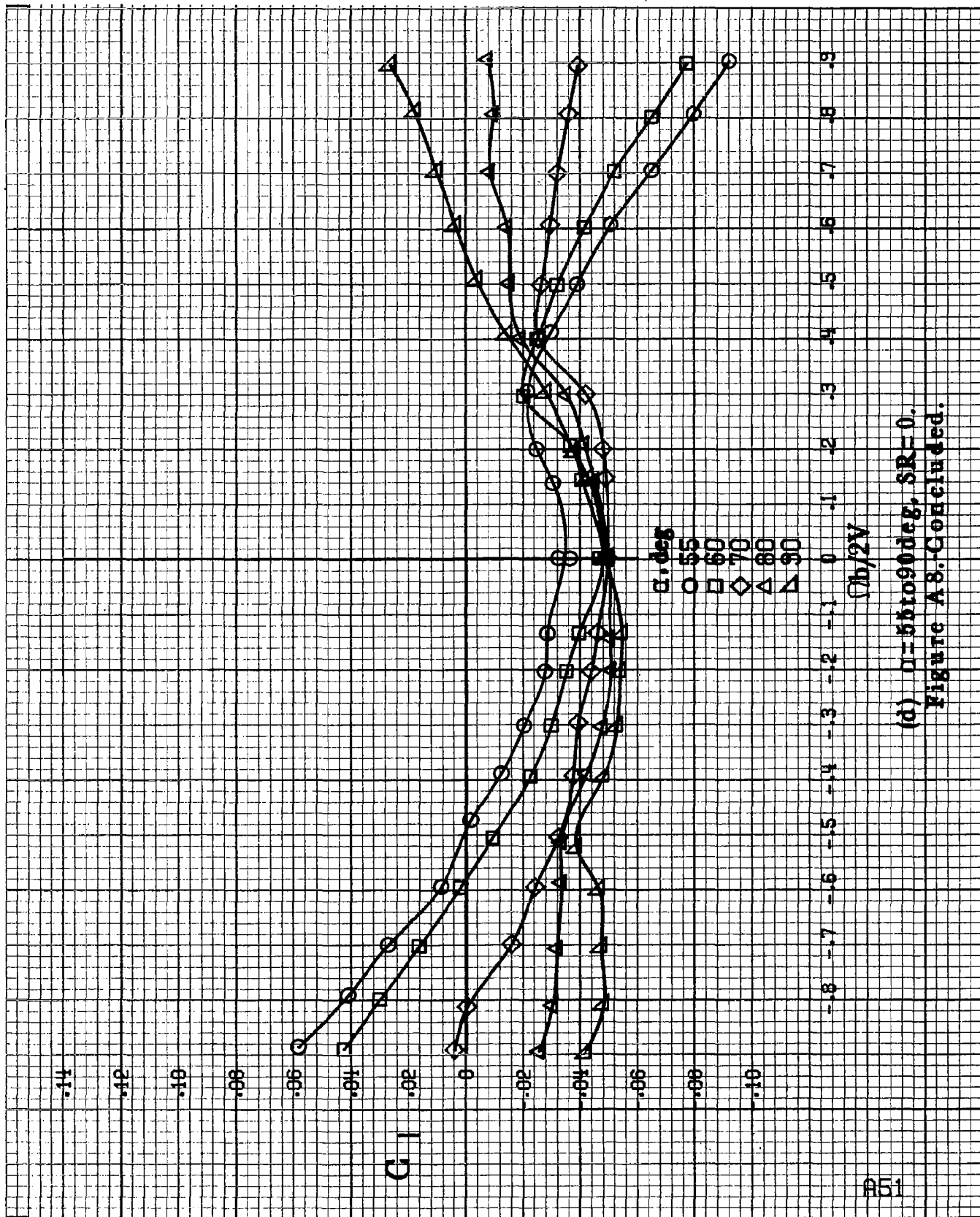


(b)  $\alpha = 18$  to  $55$  deg,  $SR = 182.9$  cm (72 in).  
 Figure A8. Continued.

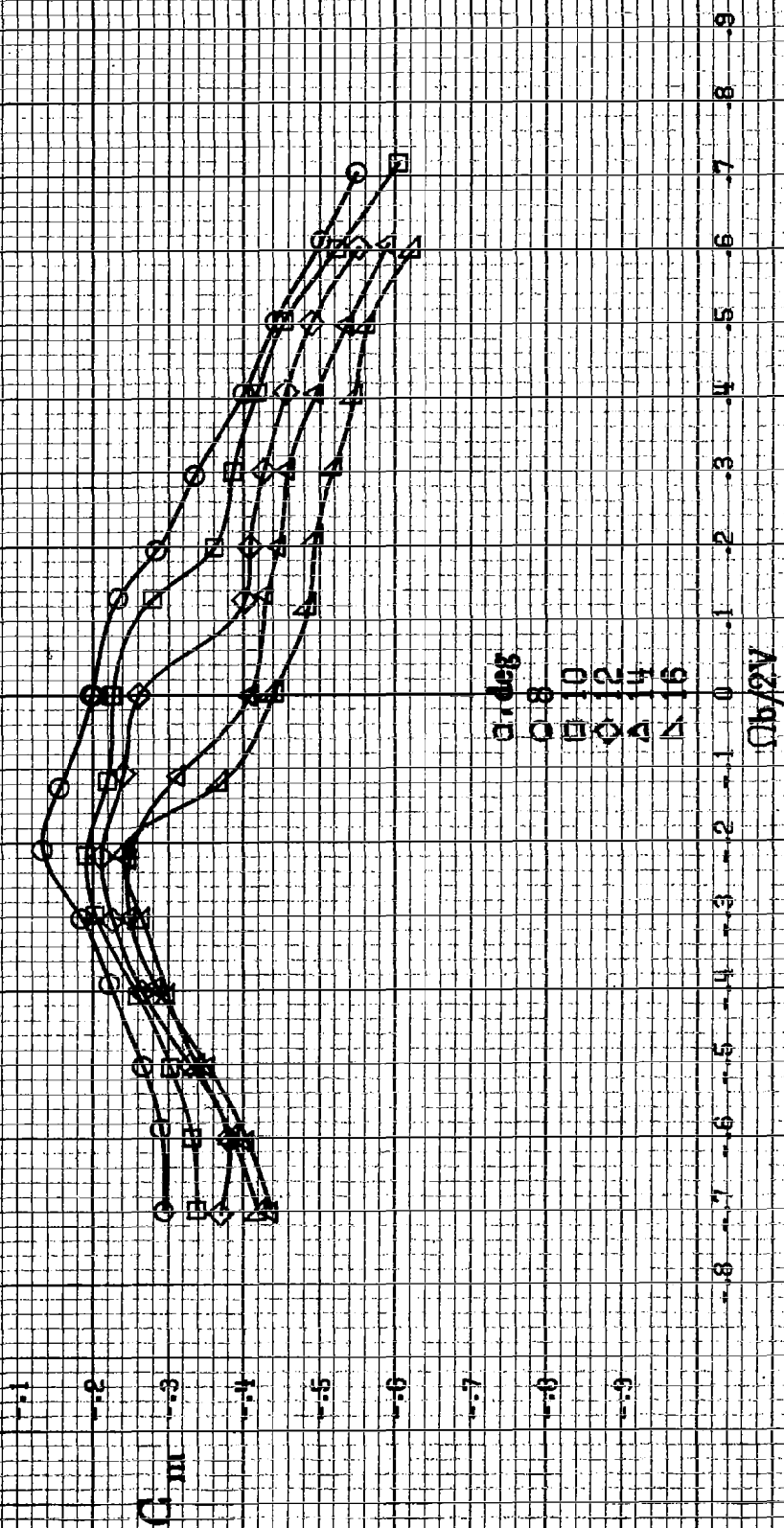
C



(c)  $\alpha = 30$  to  $50$  deg,  $SR = 0$ .  
Figure A8. Continued.

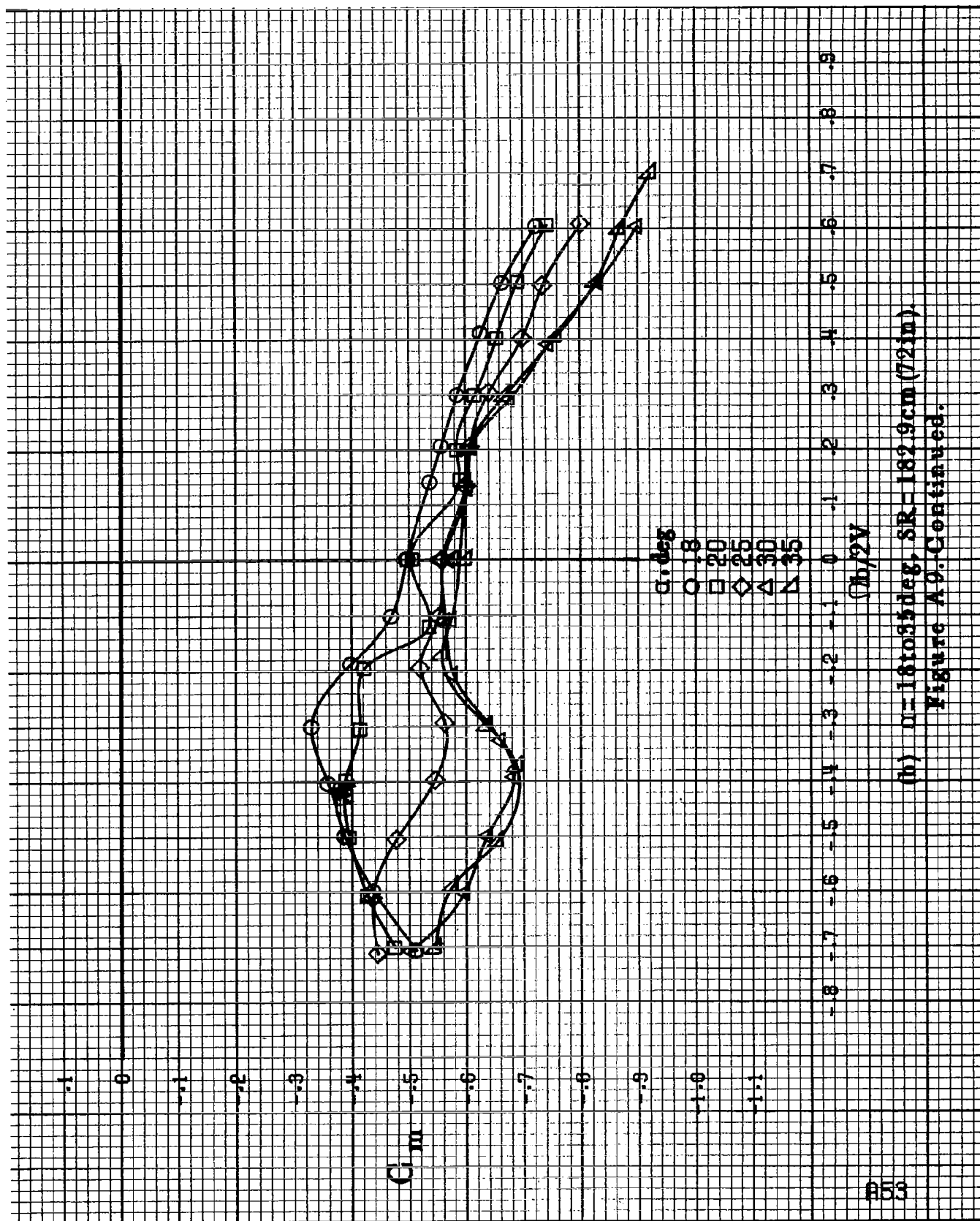


(d)  $\Omega = 581090 \text{ deg}$ ,  $SR = 0$ .  
Figure A8-Continued.

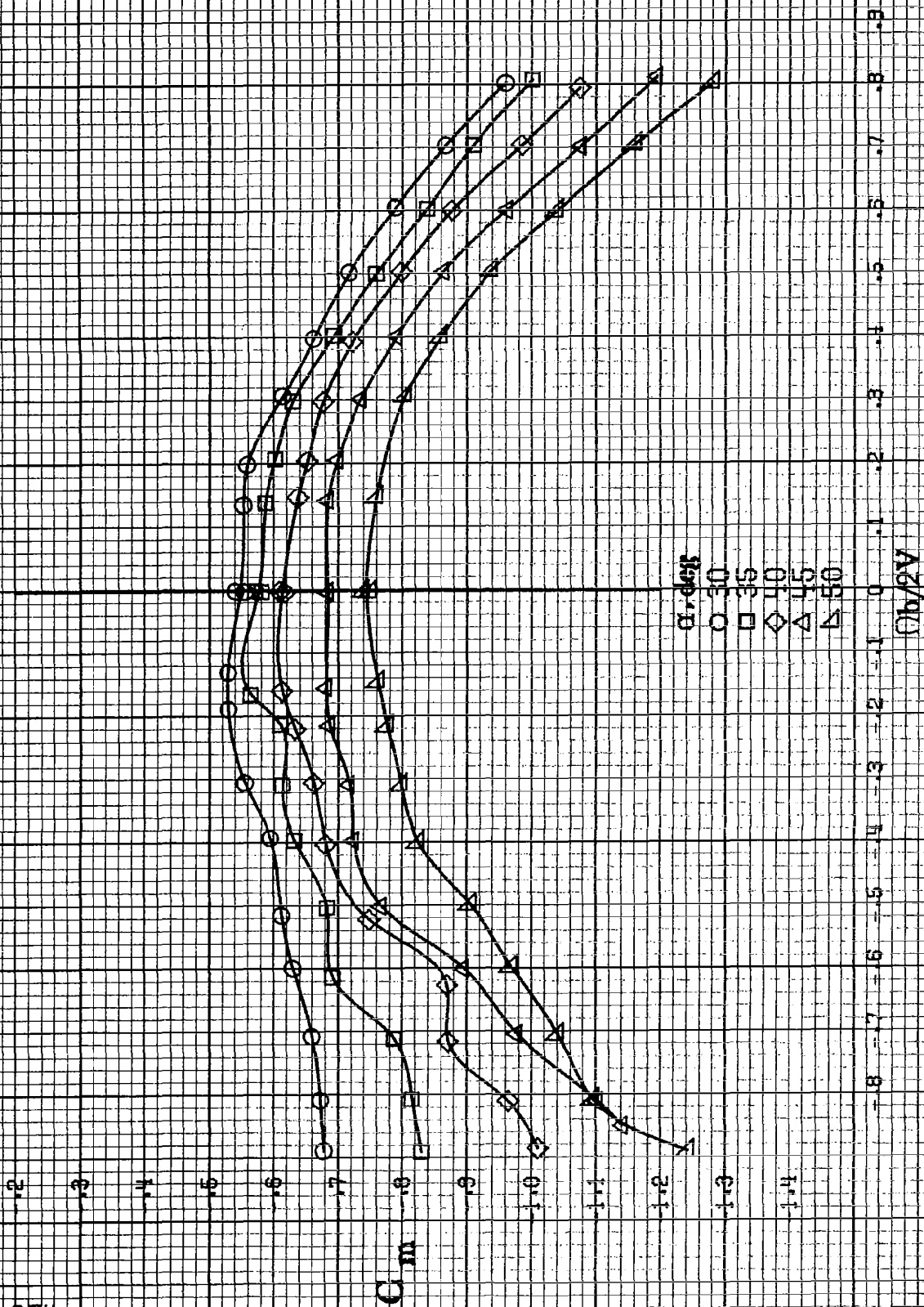


(a)  $\alpha = 8$  to  $16^\circ$ ,  $SR = 132.9 \text{ cm (72 in.)}$ .  
 Figure A9.-Effect of rotation rate and angle of attack on pitching-moment coefficient for basic configuration.  $\delta_a = 0^\circ$ ,  $\delta_b = 0^\circ$ ,  $\delta_r = 0^\circ$ ,  $\beta = 10^\circ$ .

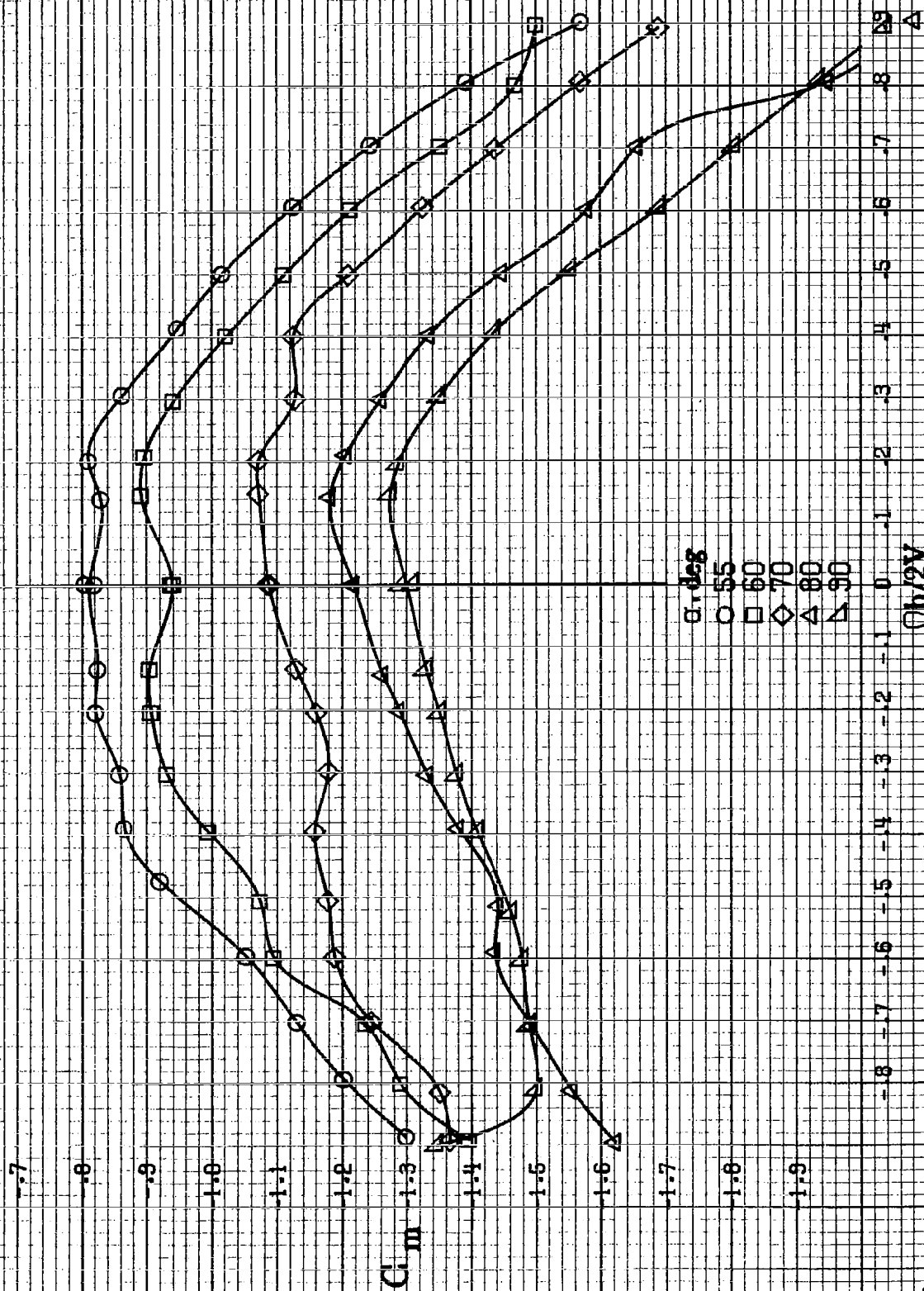




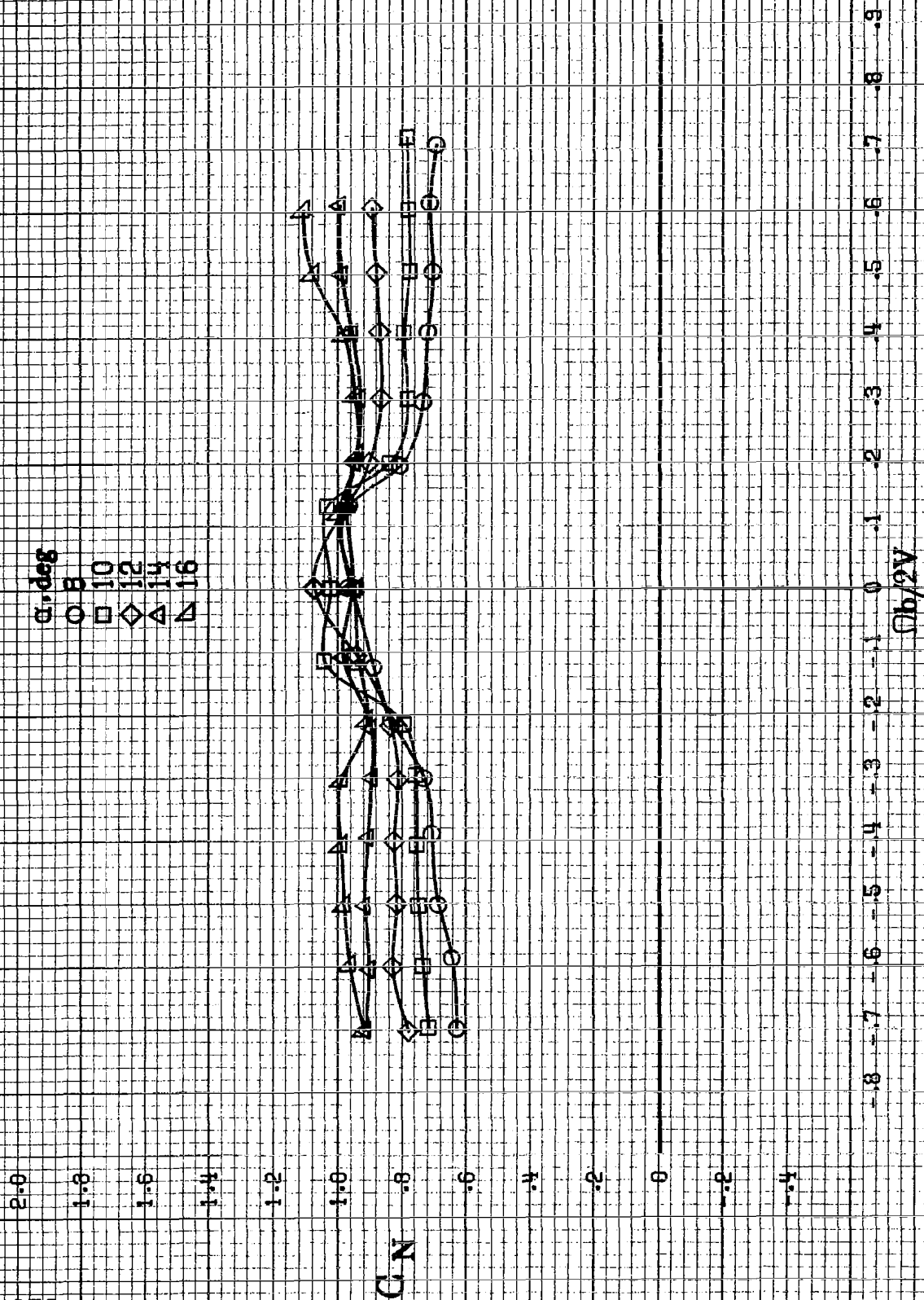
(h)  $n = 1.61035$  deg,  $SR = 182.9$  cm (72 in)  
Figure A9. Continued.



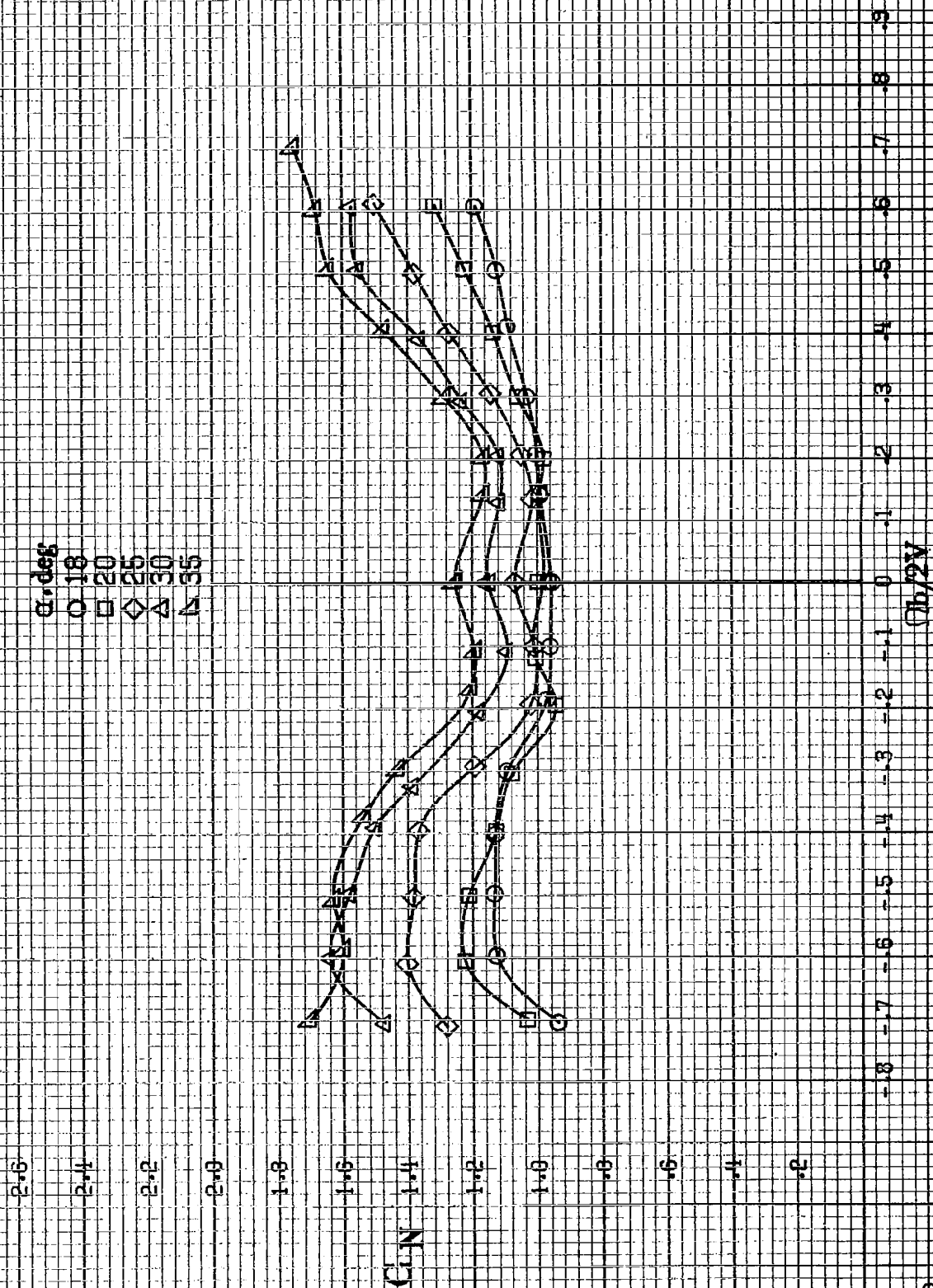
(c)  $\alpha = 30$  to  $50^\circ$ ,  $SR = 0$ .  
Figure A9-Continued.



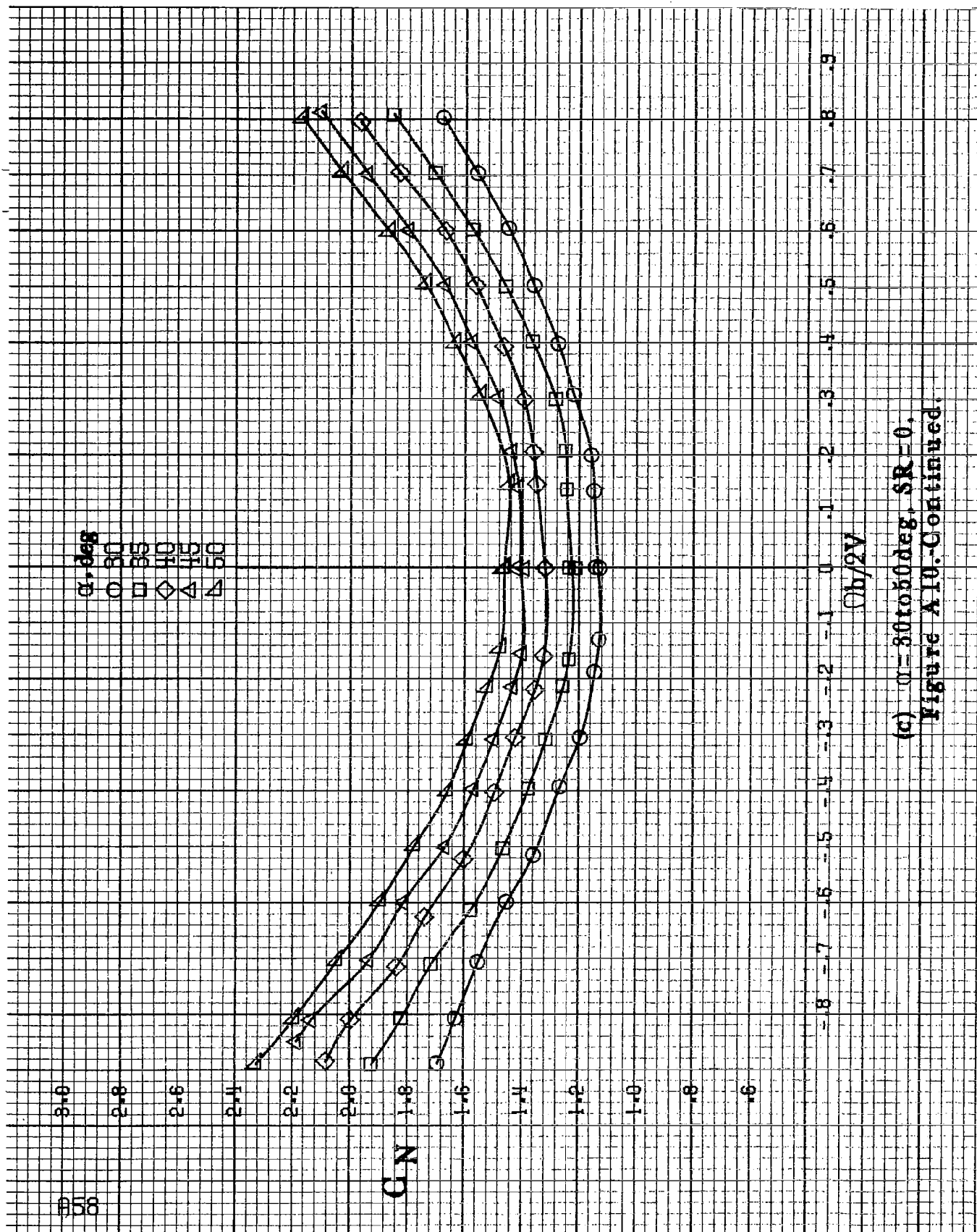
(d)  $\alpha = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A9. Concluded.



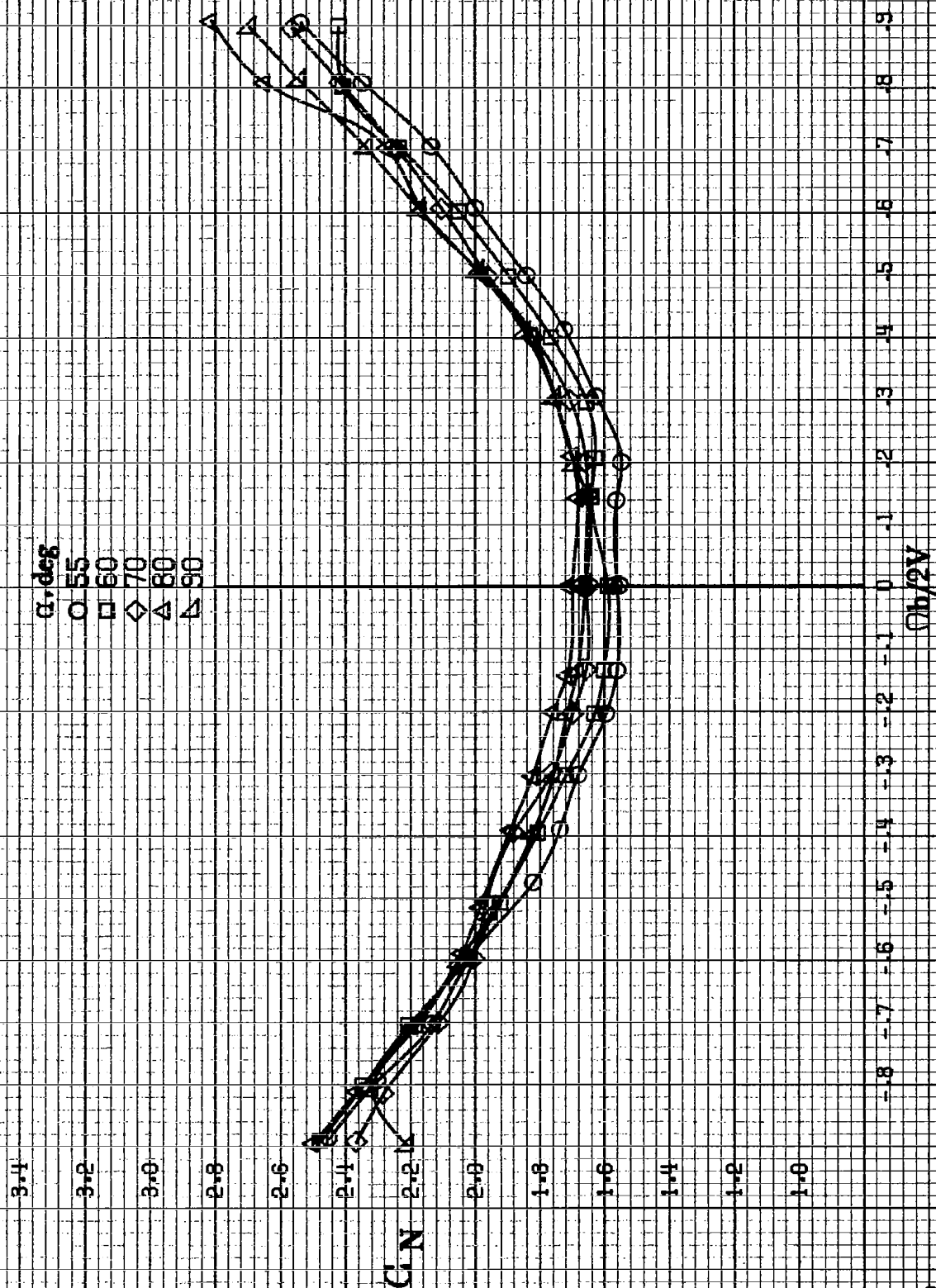
(a)  $\alpha = 8$  to  $16^\circ$ ,  $SR = 182.9 \text{ cm (72 in.)}$ .  
 Figure A10. Effect of rotation rate and angle of attack on normal force coefficient for basic configuration.  $\alpha_e = 0^\circ$ ,  $\delta_h = 0^\circ$ ,  $\delta_r = 10^\circ$ .



(b)  $\alpha = 18$  to  $35$  deg,  $SR = 182.9$  cm (72 in).  
Figure A10-Continued.



(c)  $\alpha = 30$  to  $50^\circ$ ,  $SR = 0$ .  
Figure A10. Continued.



(d)  $\alpha = 55$  to  $90$  deg,  $SR = 0$ .  
Figure A10.-Concluded.

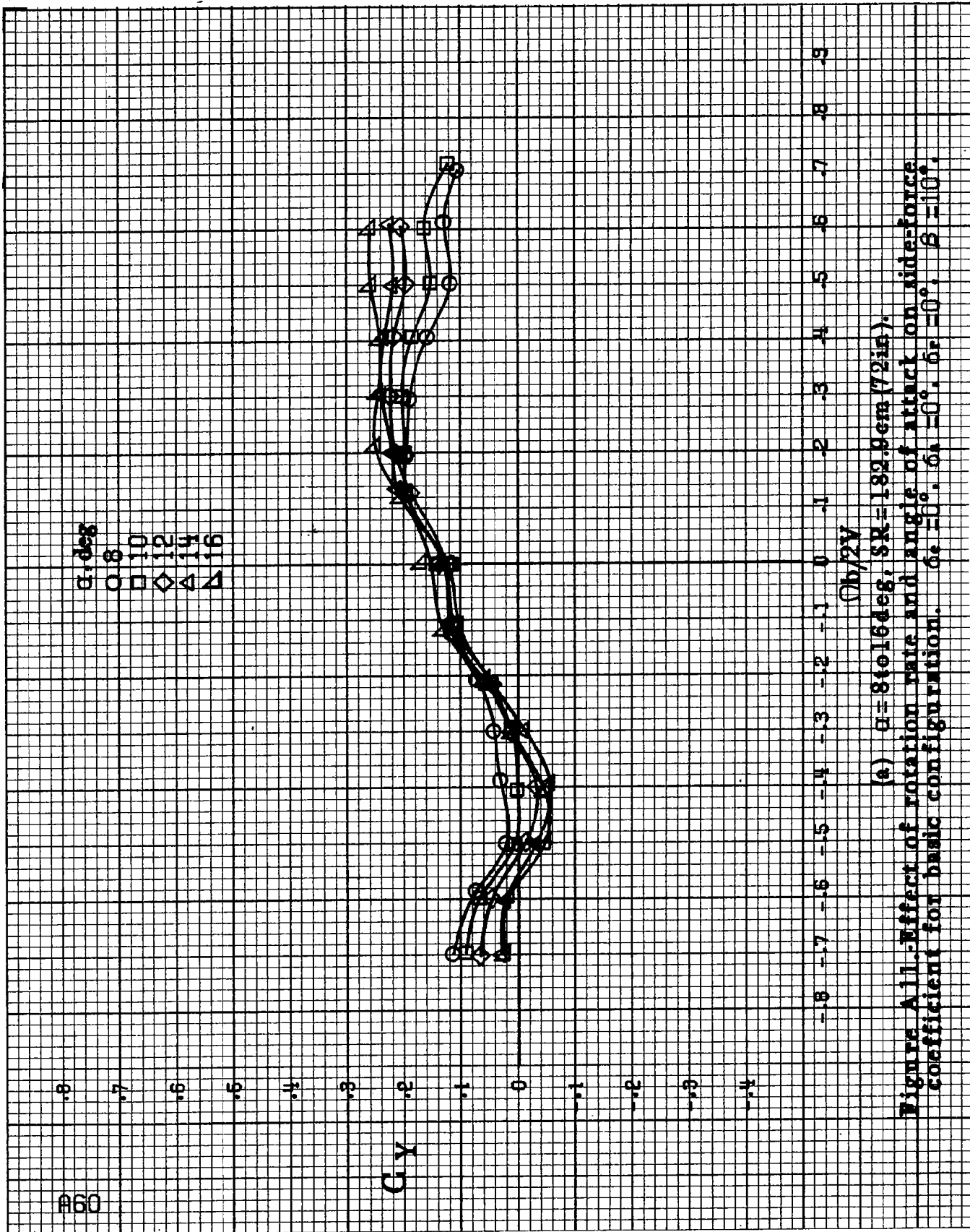
$\alpha$ , deg  
 ○ 8  
 □ 10  
 ◇ 12  
 △ 14  
 ▽ 16

$G_Y$

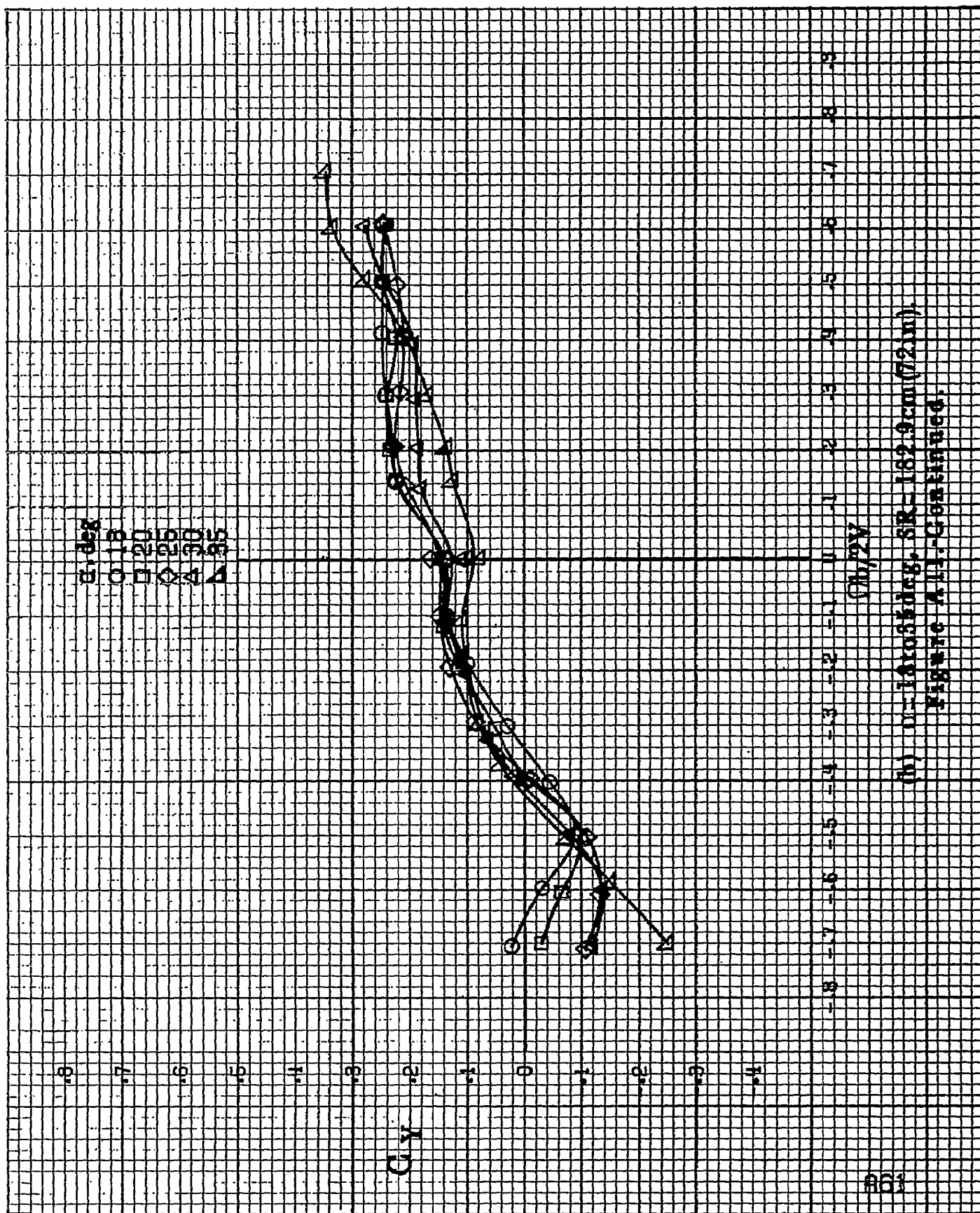
$\Omega b/2V$

(a)  $\alpha = 8$  to  $16$  deg,  $SR = 132.9$  cm (72 in).

Figure A11. Effect of rotation rate and angle of attack on side-force coefficient for basic configuration.  $\delta_e = 0^\circ$ ,  $\delta_r = 0^\circ$ ,  $\delta = 10^\circ$ .







(h)  $\alpha = 15^\circ$  to  $35^\circ$ ,  $SR = 182.9 \text{ cm (72 in.)}$   
 Figure A11-Continued.

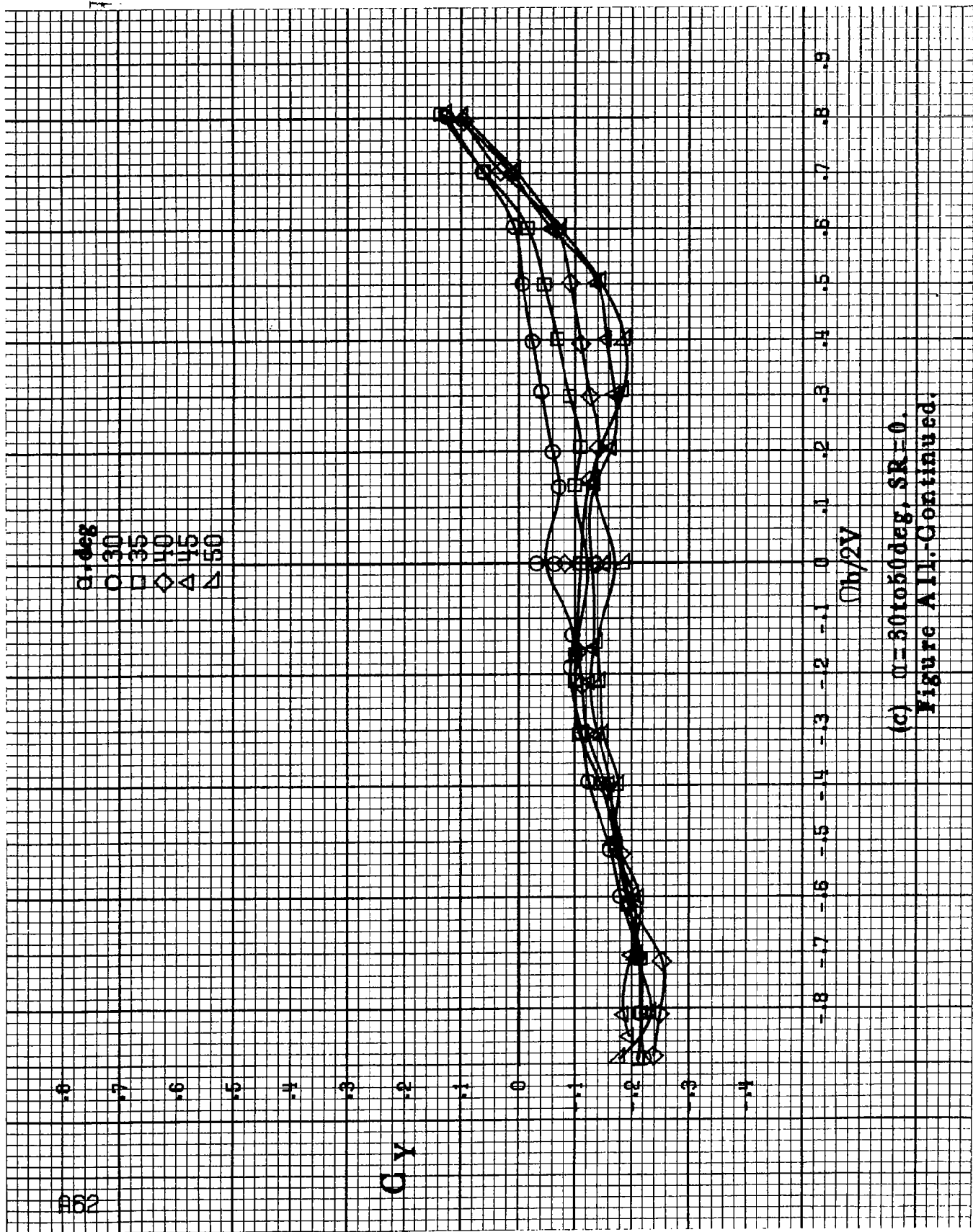
$\alpha$ , deg

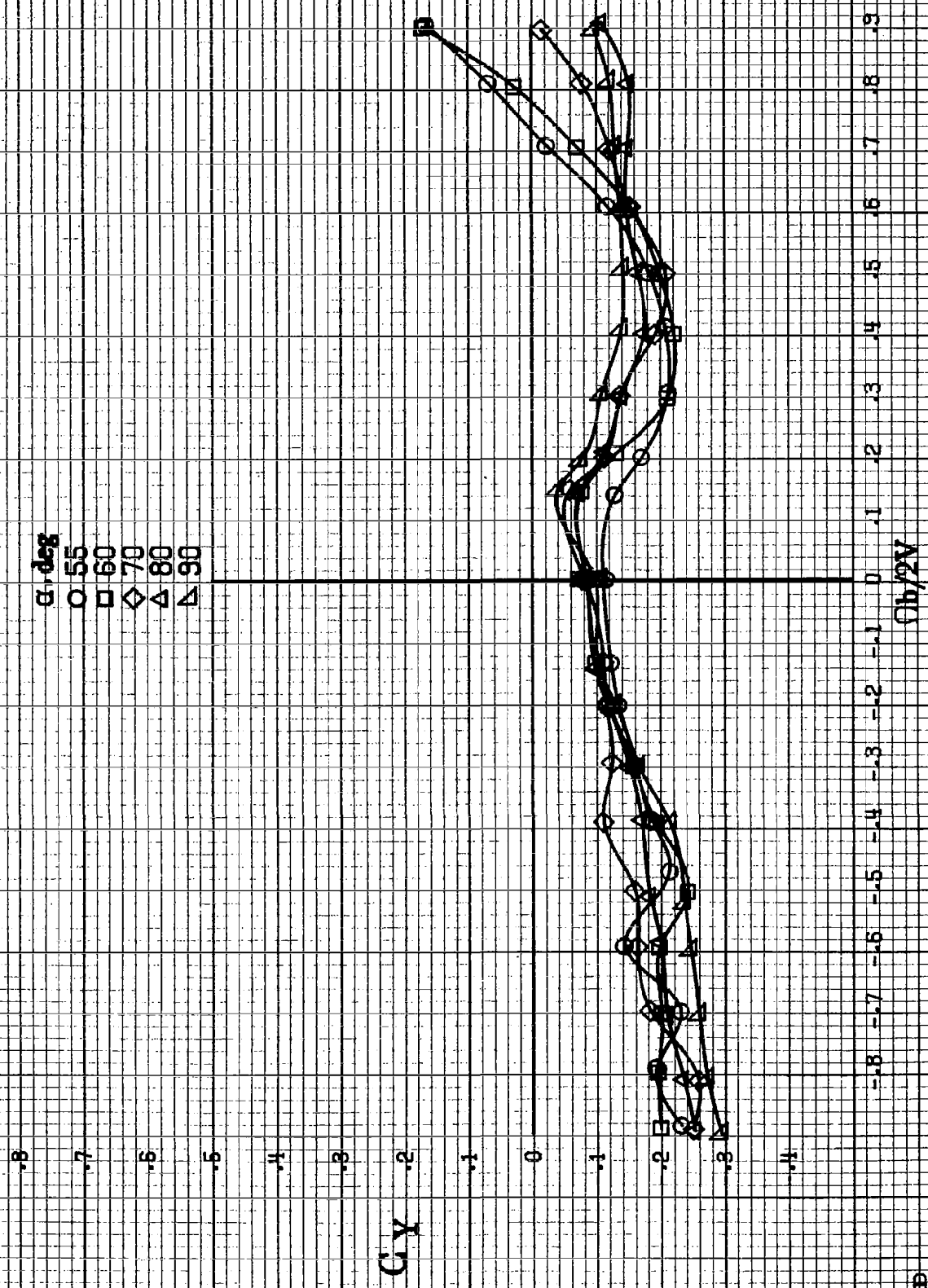
○ 30  
□ 35  
◇ 40  
△ 45  
▽ 50

$C_Y$

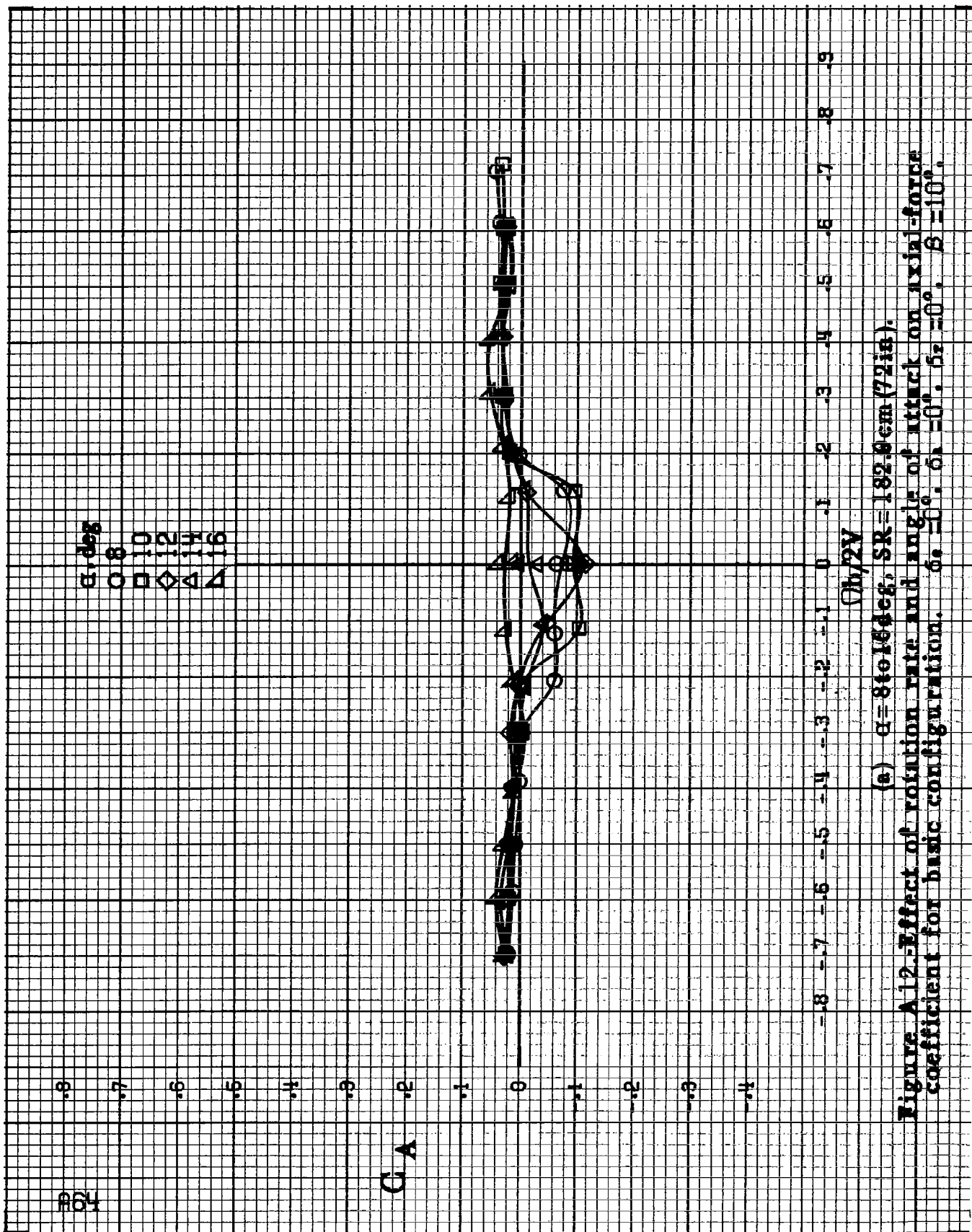
$Ob/2V$

(c)  $\alpha = 30$  to  $50$  deg,  $SR = 0$ .  
Figure A11-Continued.



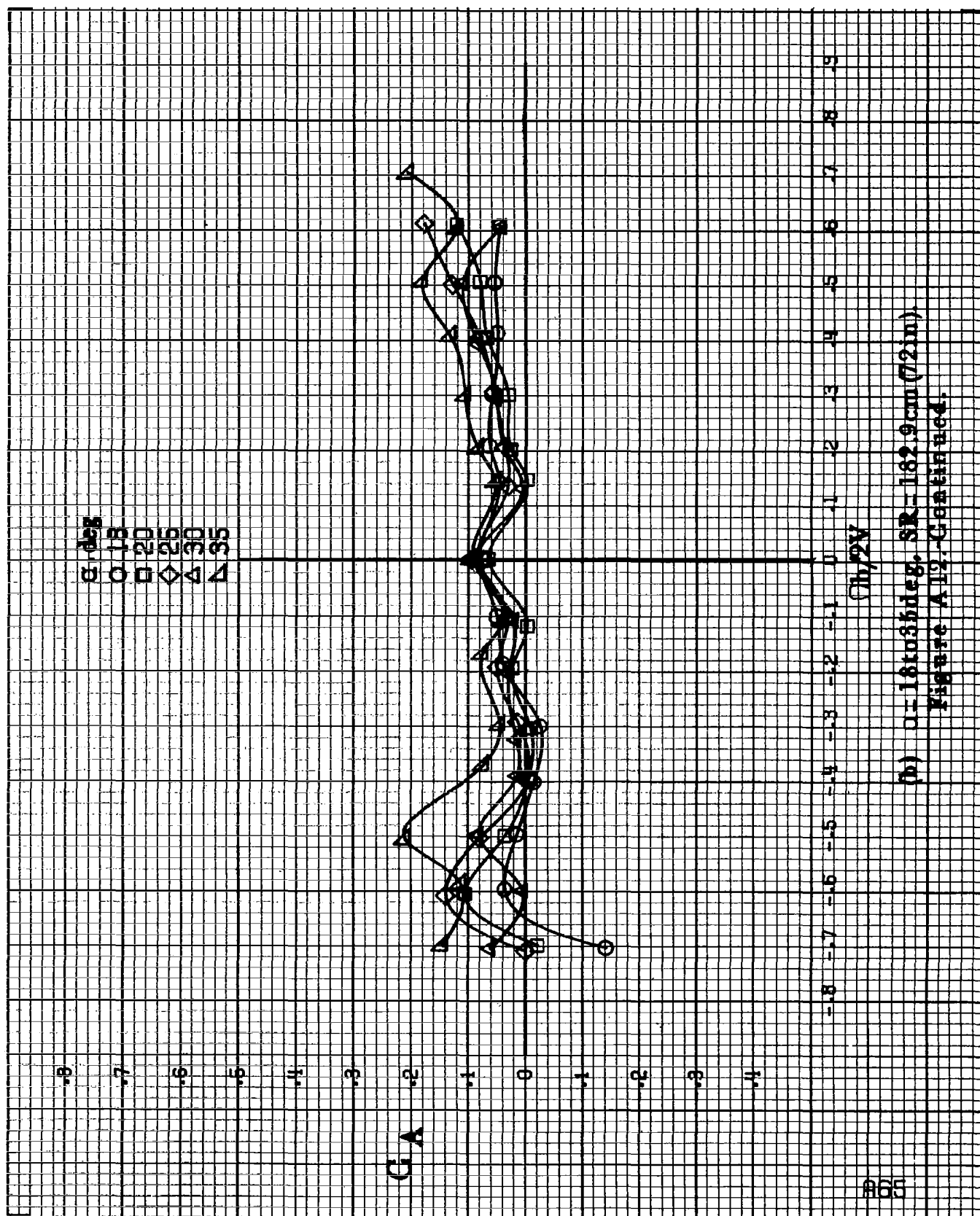


(d)  $\alpha = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A11. Concluded.



(a)  $\alpha = 8$  to  $16^\circ$ ,  $SR = 182.9 \text{ cm (72 in.)}$ .

Figure A12.-Effect of rotation rate and angle of attack on axial-force coefficient for basic configuration.  $\delta_a = 10^\circ$ ,  $\delta_s = 0^\circ$ ,  $\delta_r = 10^\circ$ .



(b)  $\alpha = 18$  to  $35$  deg. SR =  $162.9$  cm (72 in).  
Figure A12. Continued.

$\alpha, \text{deg}$   
 $\circ$  30  
 $\square$  35  
 $\diamond$  40  
 $\triangle$  45  
 $\nabla$  50

$G_A$



$C_b/2V$

(c)  $\alpha=30$  to  $50^\circ$ ,  $SR=0$ .  
 Figure A 12.-Continued.

$\alpha$ , deg  
 O 55  
 □ 60  
 ◇ 70  
 △ 80  
 ▲ 90

$C_1 A$

$Cb/2V$

(d)  $\alpha = 55$  to  $90$  deg,  $SR = 0$ .  
 Figure A12.-Continued.

$\alpha, \text{deg}$   
 8  
 10  
 12  
 14  
 16

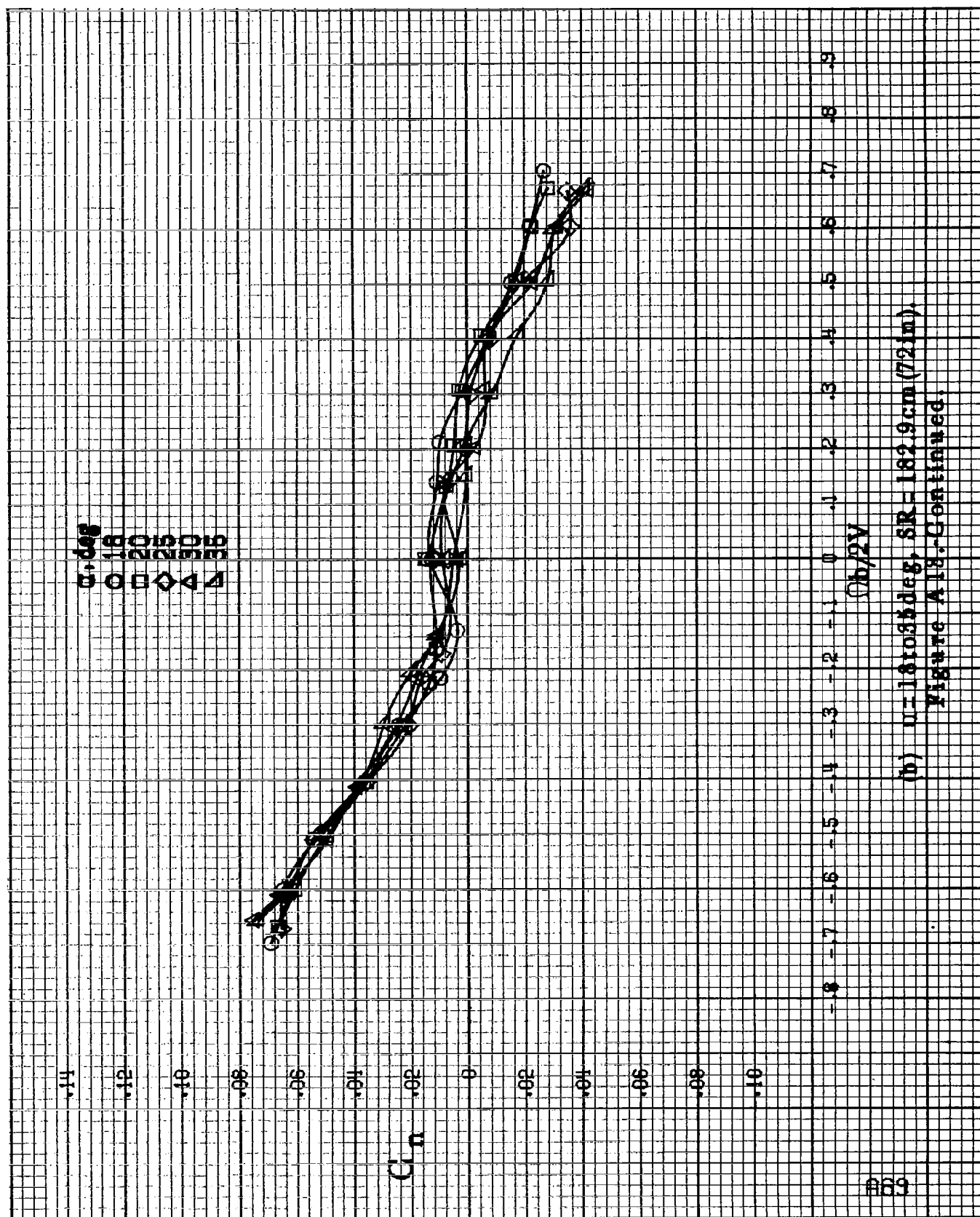


(a)  $\alpha = 8$  to  $16^\circ$ ,  $SR = 182.9 \text{ cm (72 in.)}$ .

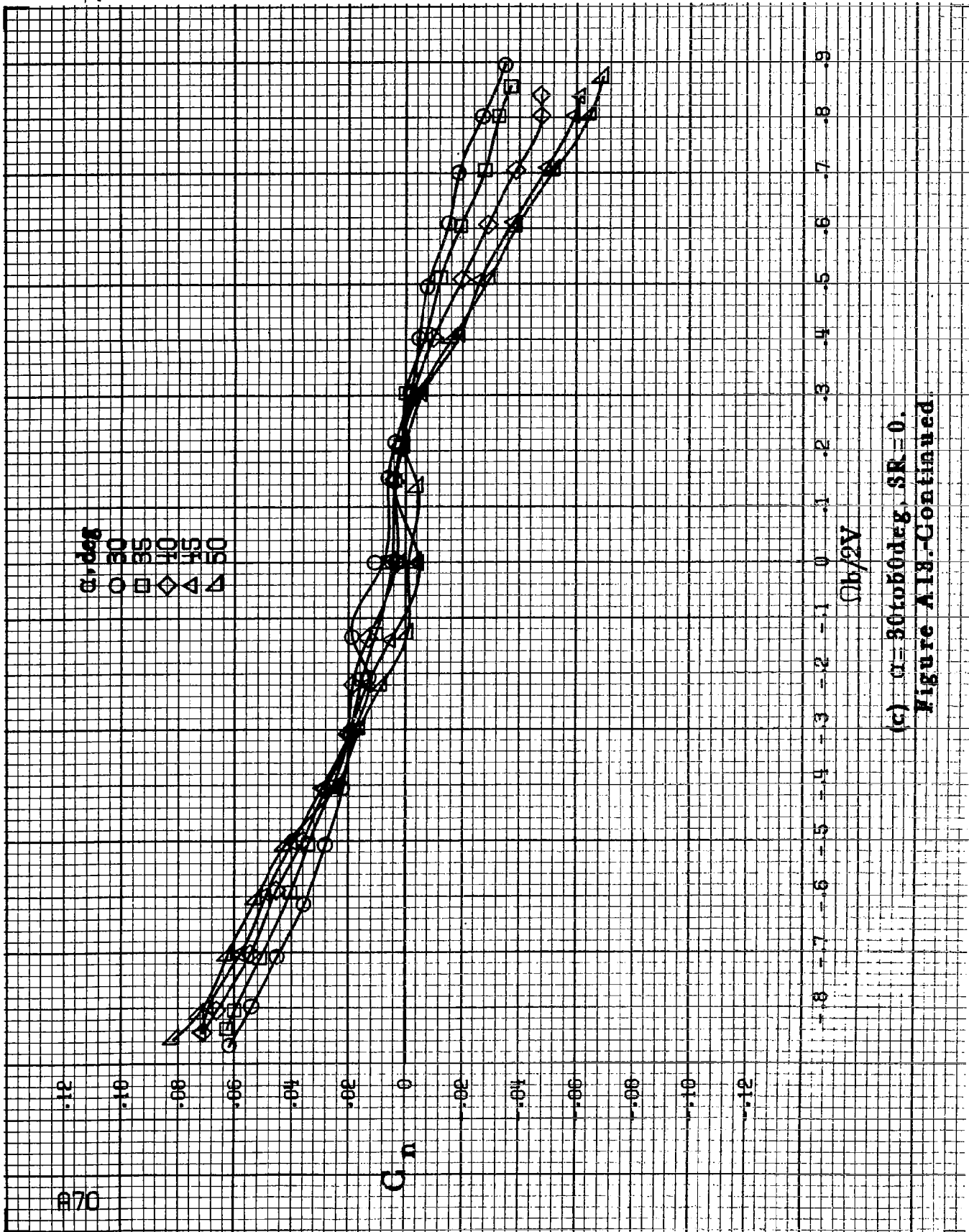
(b)  $2V$

Figure A18. Effect of rotation rate and angle of attack on yawing-moment coefficient for basic configuration.  $\delta_a = 15^\circ$ ,  $\delta_e = 0^\circ$ ,  $\delta_r = 25^\circ$ ,  $\beta = 0^\circ$ .

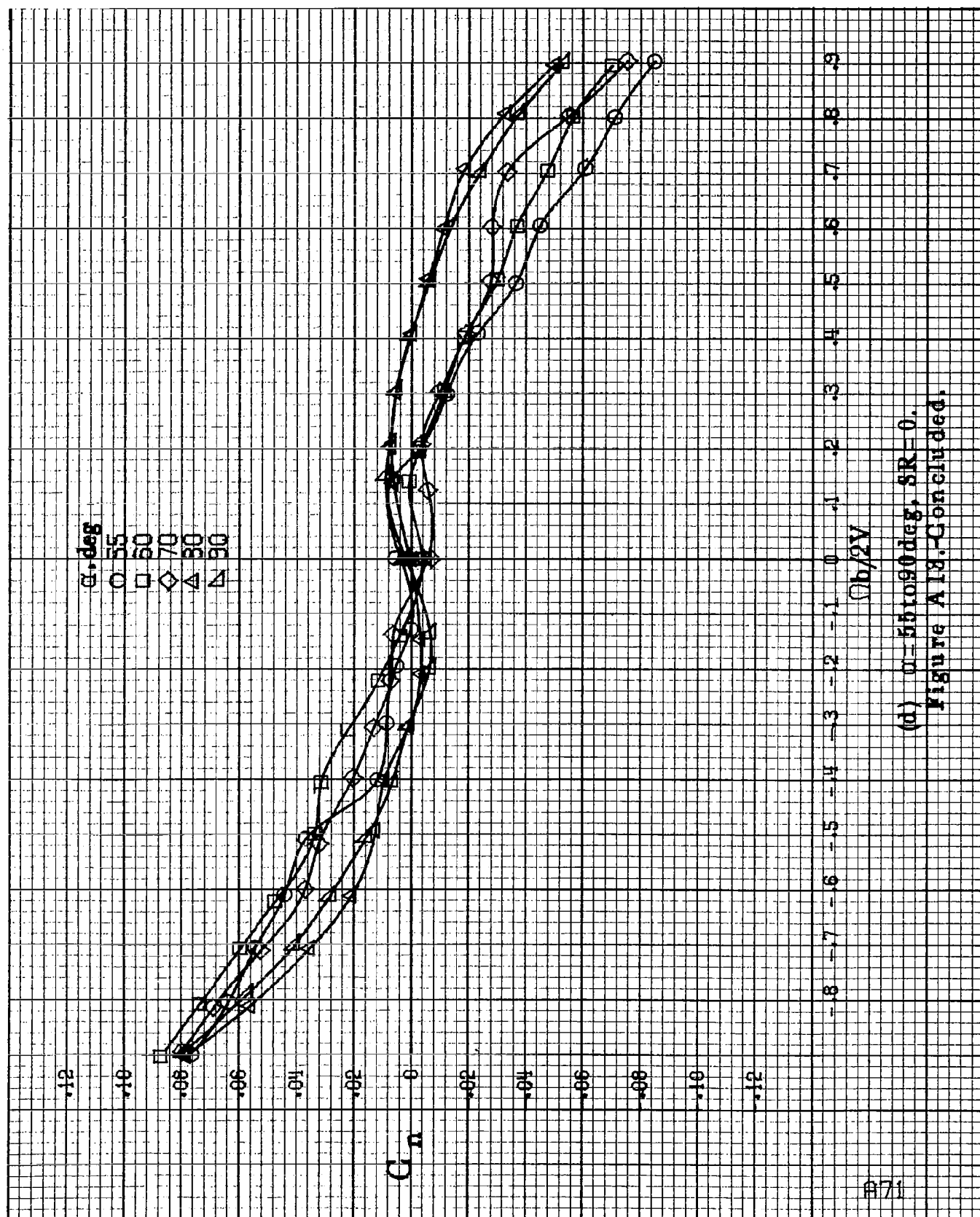




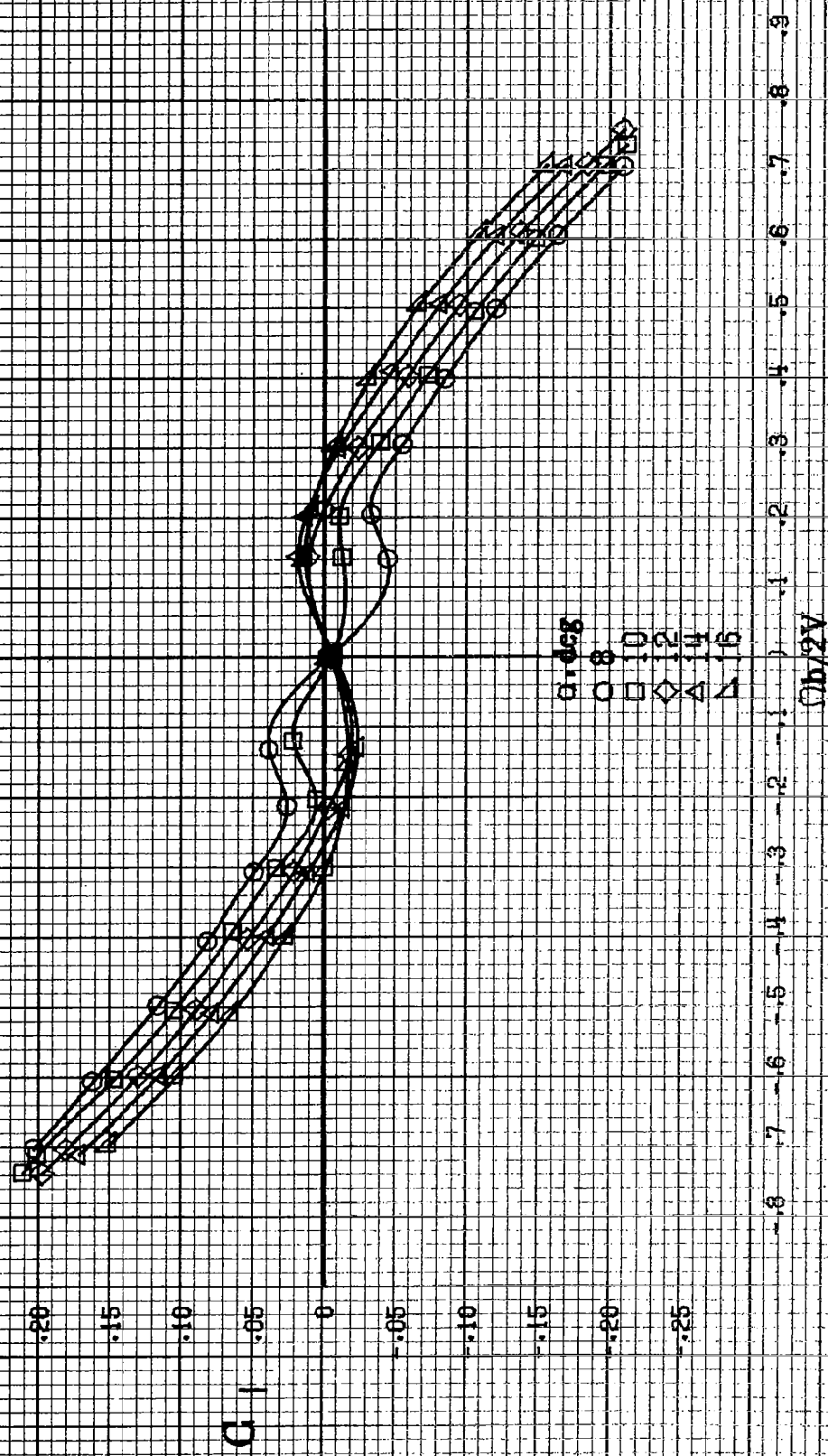
(b)  $\alpha = 16$  to  $35^\circ$ ,  $SR = 182.9 \text{ cm (72 in.)}$ .  
Figure A18-Continued.



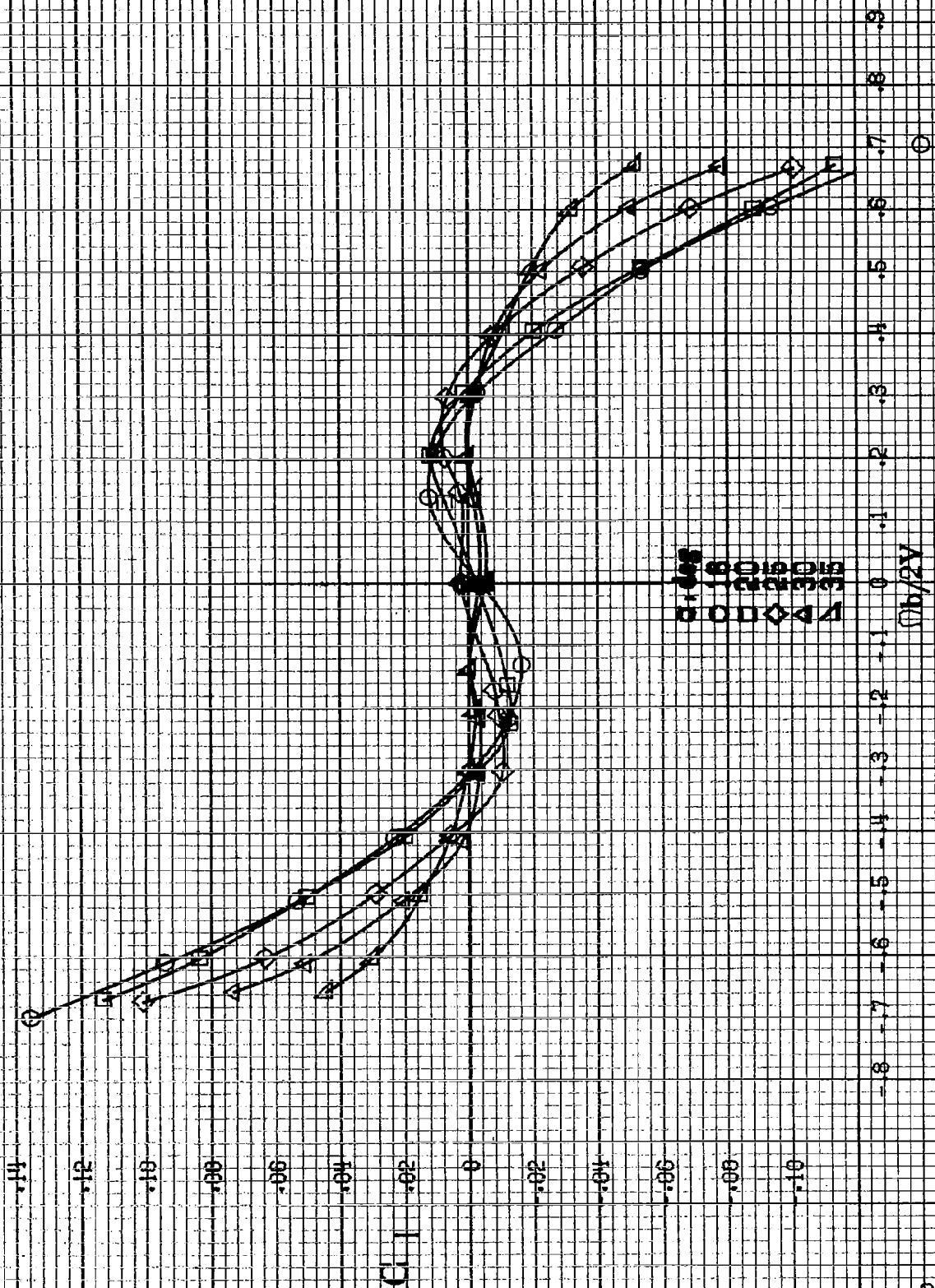
(c)  $\alpha=30$  to  $50^\circ$ ,  $SR=0$ .  
 Figure A13-Continued.



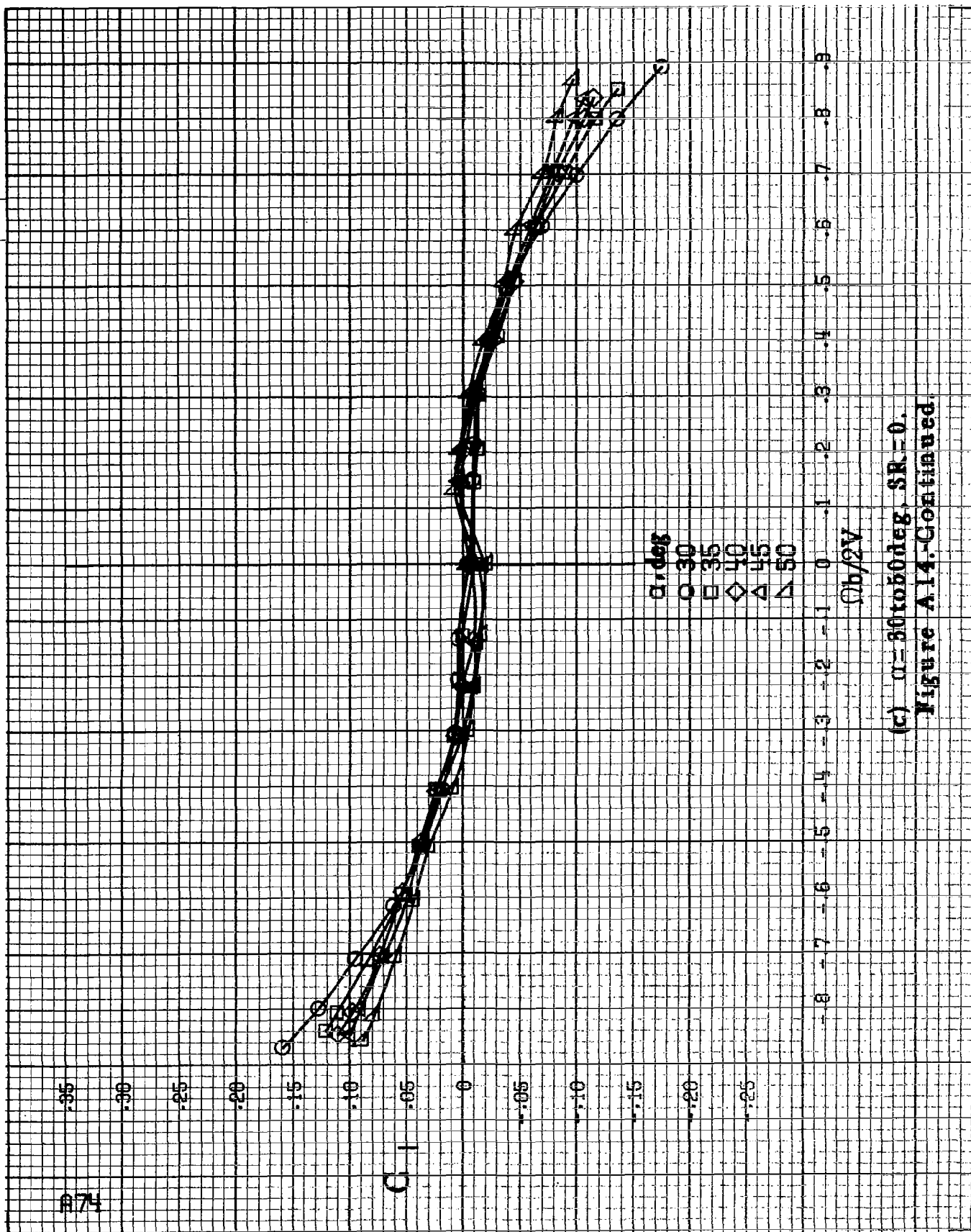
(d)  $\alpha = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A18.-Concluded.



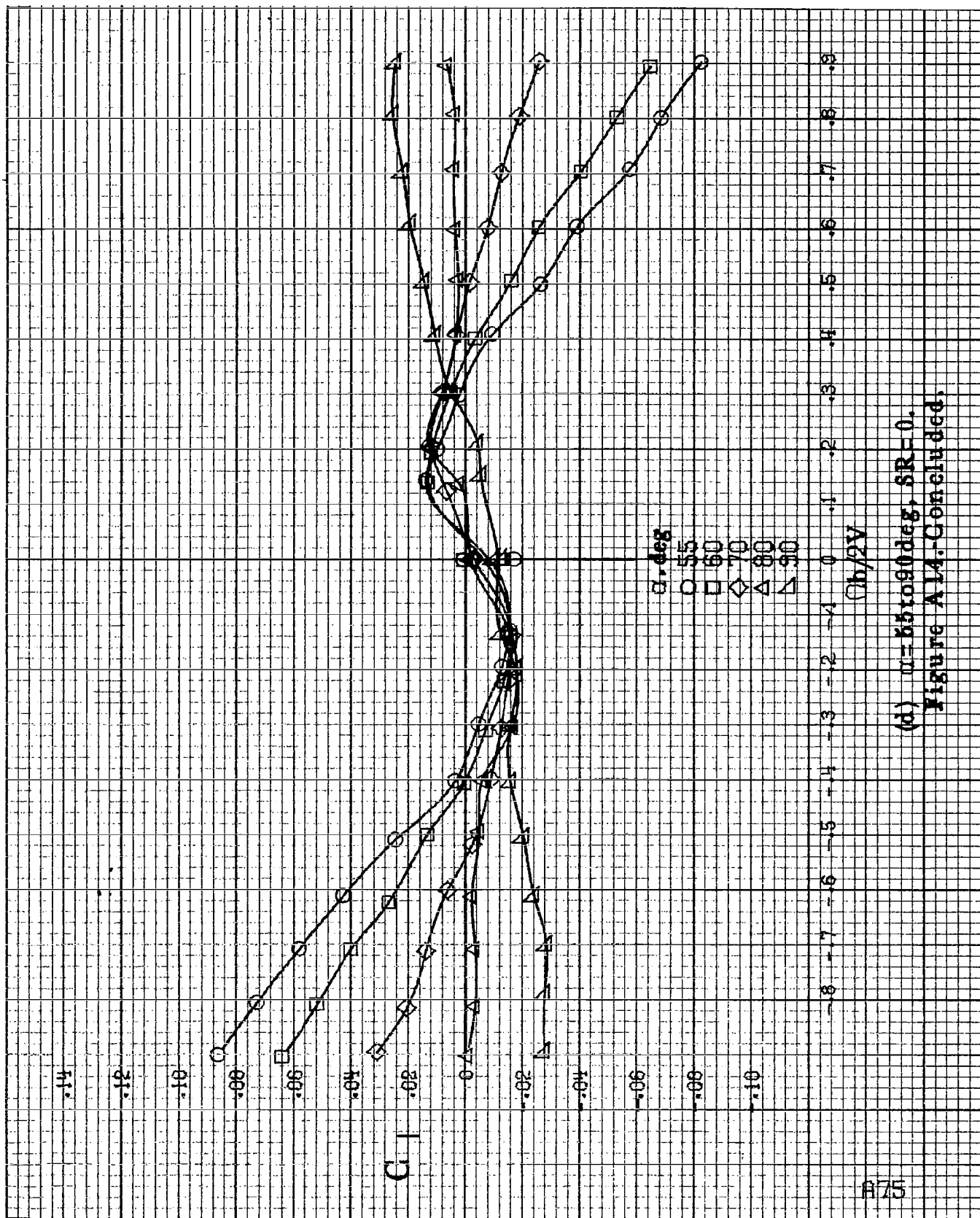
(a)  $\alpha = 8$  to  $16$  deg,  $SR = 182.9$  cm (72 in).  
 Figure A14. Effect of rotation rate and angle of attack on rolling-moment coefficient for basic configuration.  $\delta_e = 15^\circ$ ,  $\delta_a = 0^\circ$ ,  $\delta_r = 25^\circ$ ,  $\beta = 0^\circ$ .



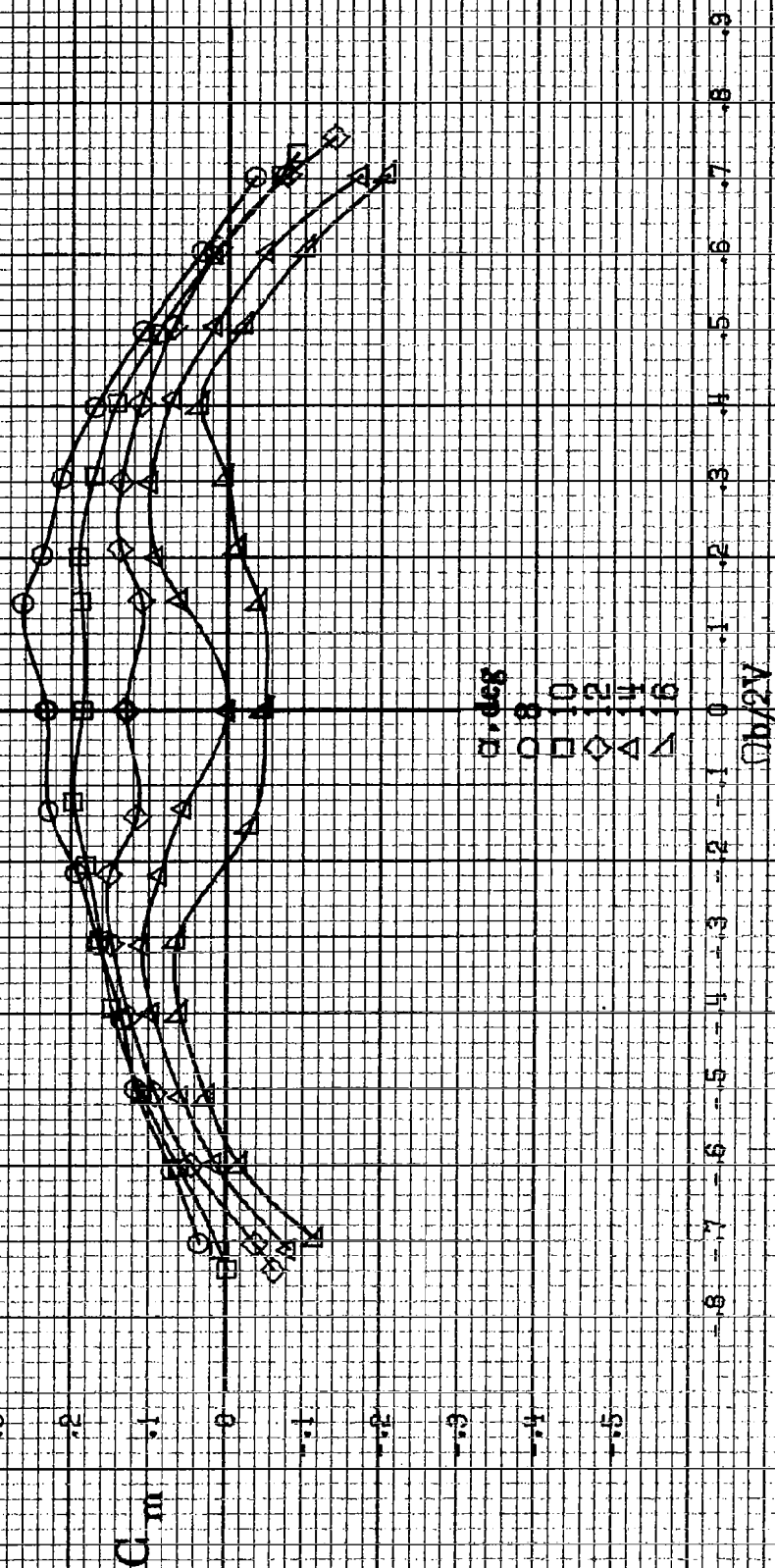
(b)  $\alpha = 18$  to  $88$  deg,  $SR = 182.9$  cm (72 in).  
Figure A14.-Continued.



(c)  $\alpha = 30$  to  $50^\circ$ ,  $SR = 0$ .  
Figure A14-Continued



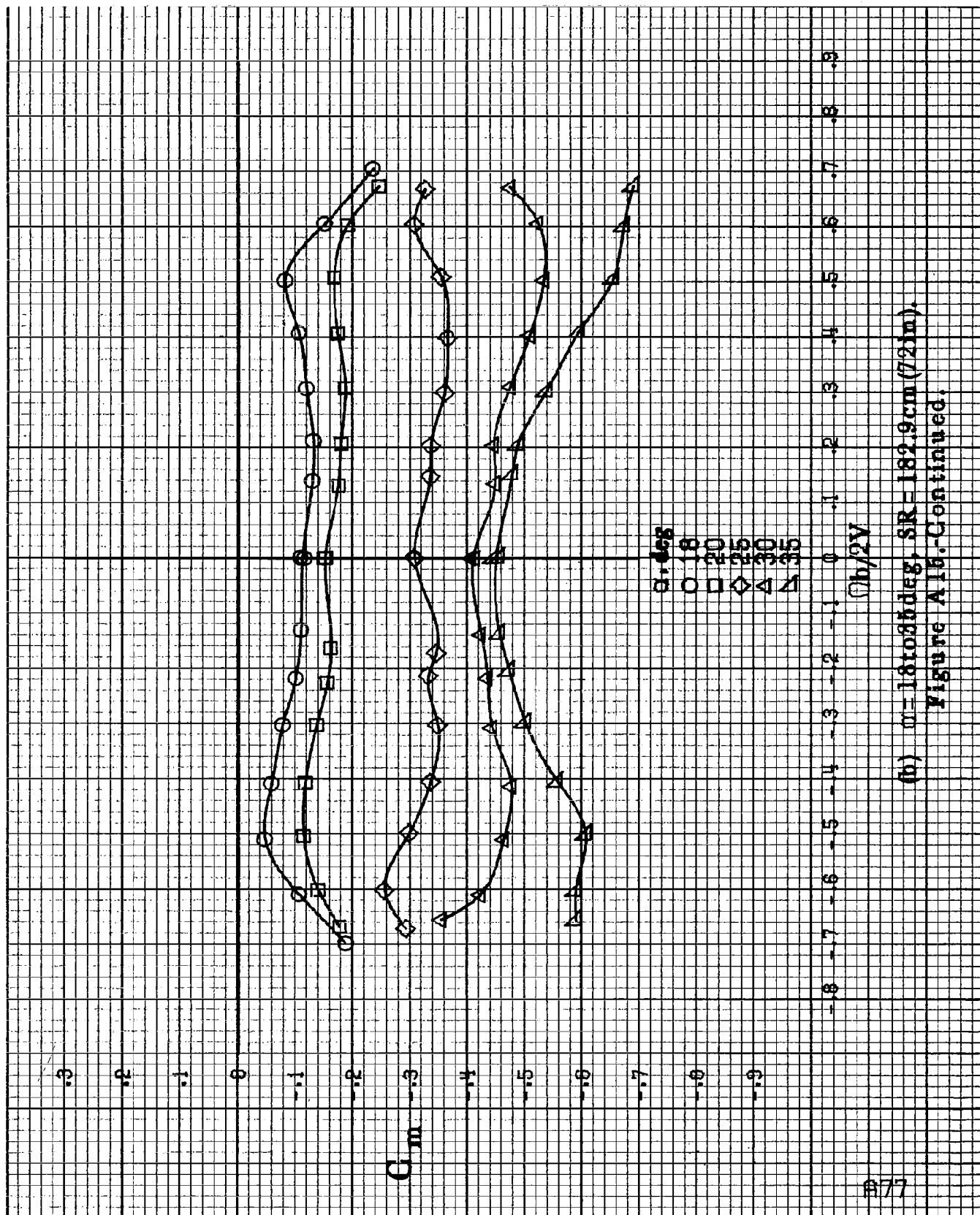
(d)  $\mu=55$  to  $90^\circ$ ,  $SR=0$ .  
Figure A14-Concluded.



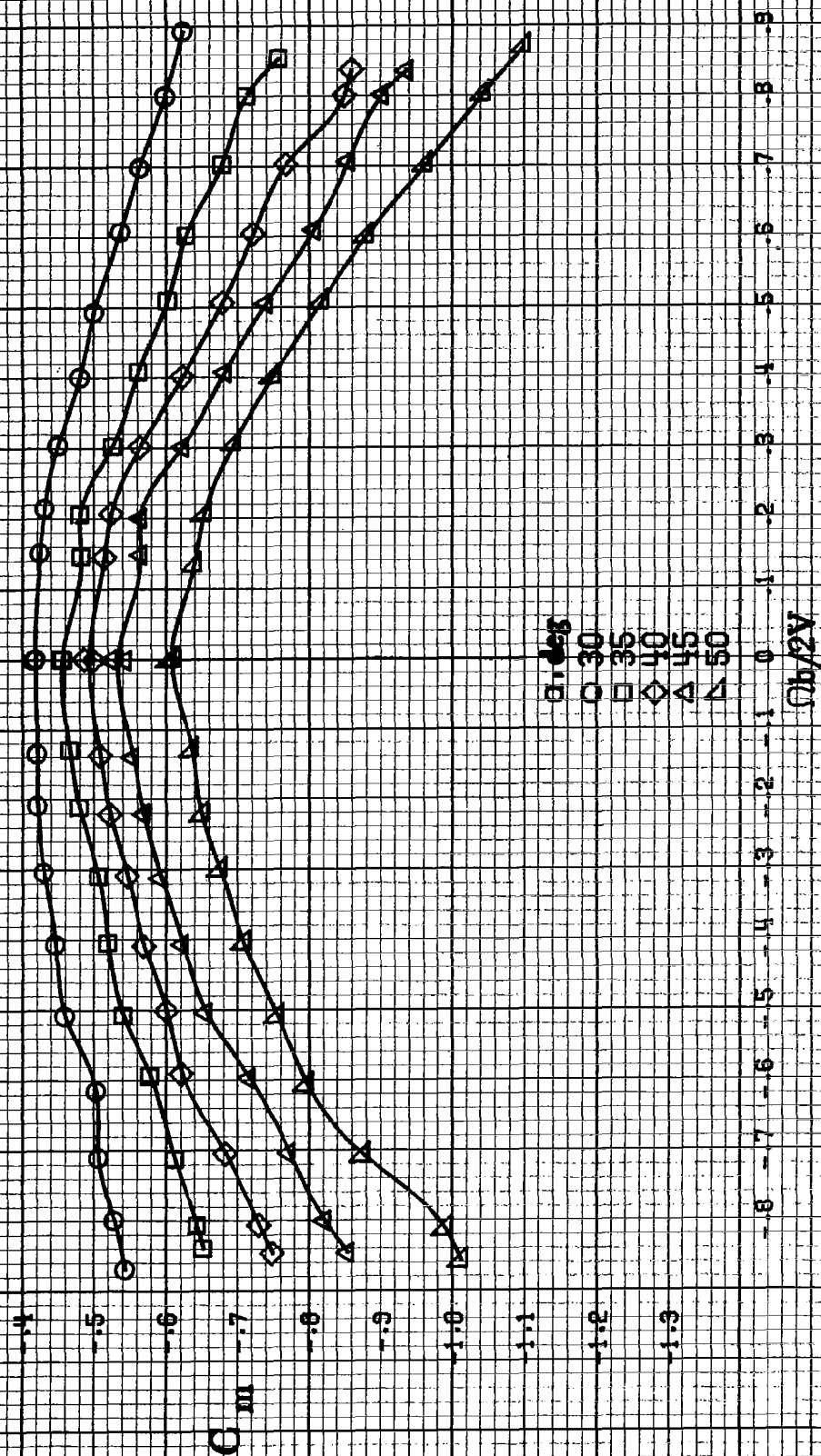
(a)  $\alpha = 8$  to  $16 \text{ deg}$ ,  $SR = 182.9 \text{ cm (72 in.)}$ .

Figure A16. Effect of rotation rate and angle of attack on pitching moment coefficient for basic configuration.  $\delta_a = 15^\circ$ ,  $\delta_s = 0^\circ$ ,  $\delta_r = 25^\circ$ ,  $\beta = 0^\circ$ .

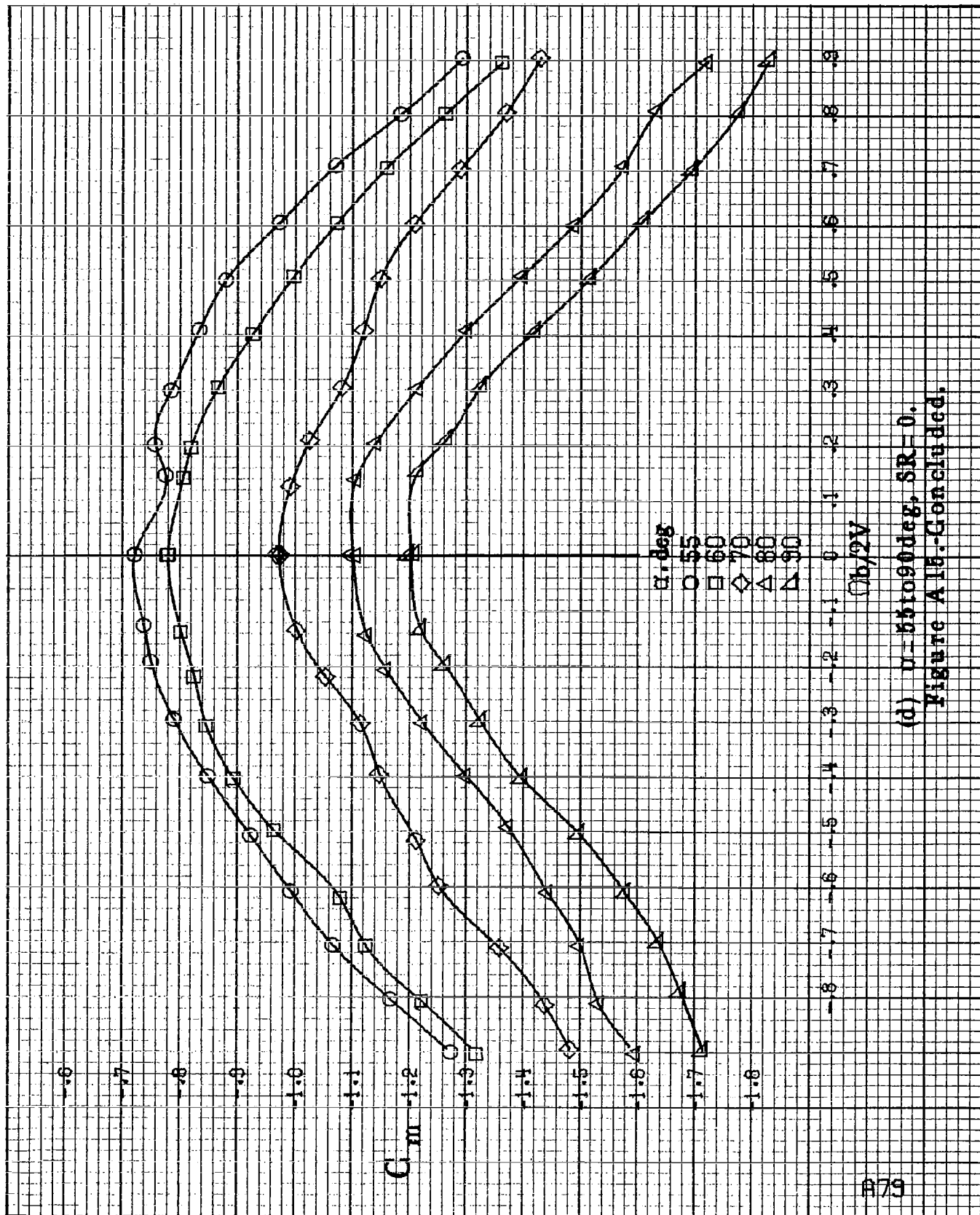




(b)  $m = 18$  to  $35^\circ$ ,  $SR = 182.9 \text{ cm (72 in.)}$ .  
Figure A16.-Continued.



(c)  $\alpha = 30$  to  $50^\circ$ ,  $SR = 0$ .  
Figure A.15. Continued.



(d)  $u=55$  to  $90$  deg,  $SR=0$ .  
Figure A18-Continued.

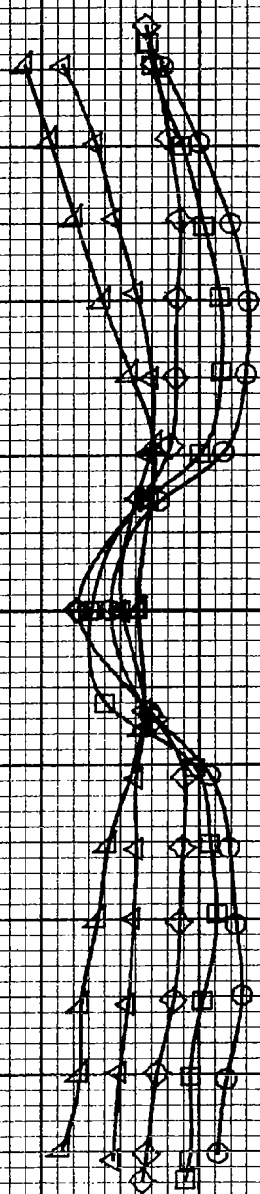
$\alpha, \text{deg}$   
 8  
 10  
 12  
 14  
 16

$C/N$

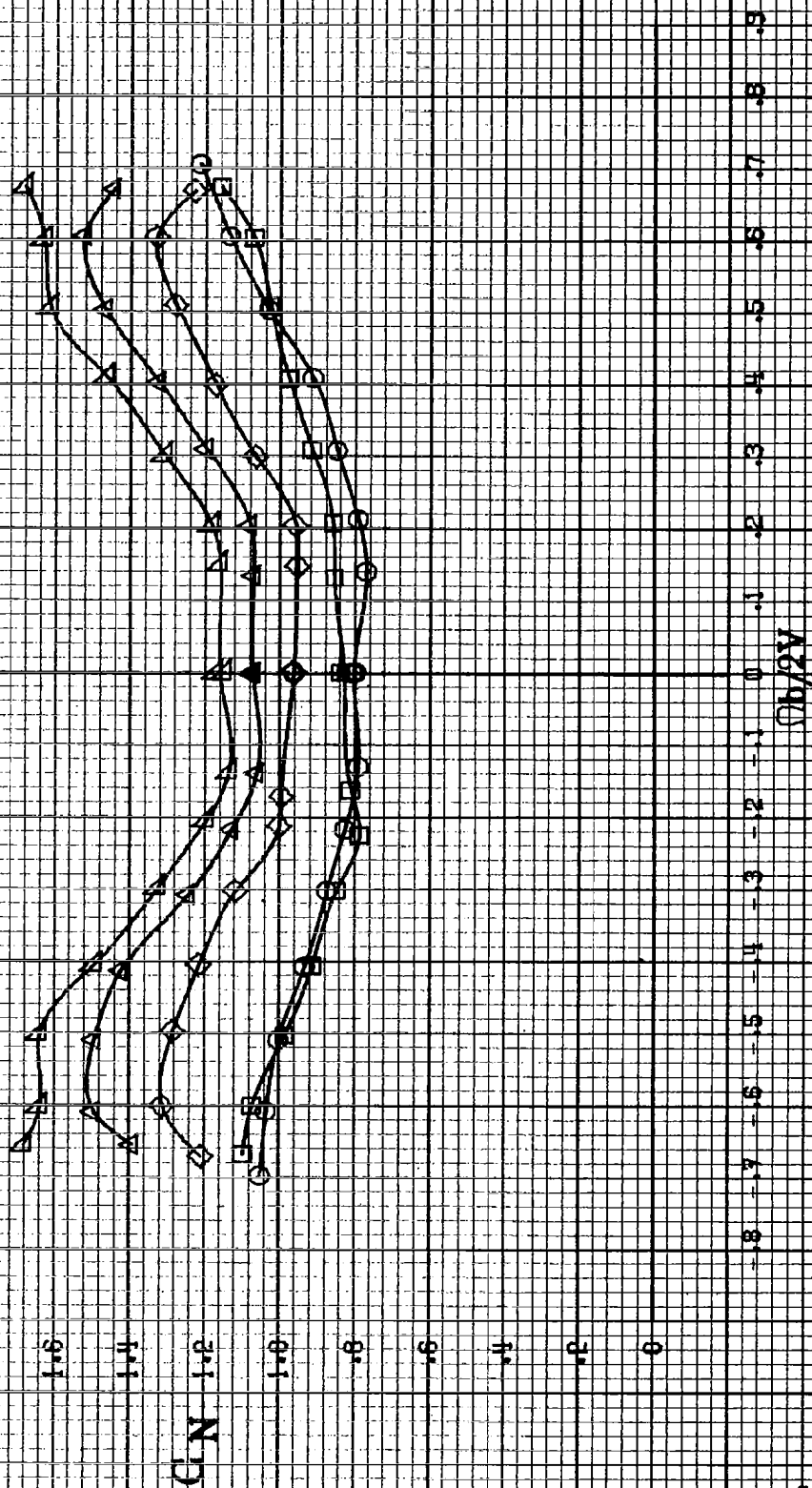
$\phi b/2V$

(a)  $\alpha = 8 \text{ to } 16 \text{ deg}$ ,  $SR = 182.9 \text{ cm (72 in.)}$ .

Figure A16. Effect of rotation rate and angle of attack on normal-force coefficient for basic configuration.  $\phi_s = -15^\circ$ ,  $\phi_n = 0^\circ$ ,  $\phi_r = 25^\circ$ ,  $\theta = 0^\circ$ .

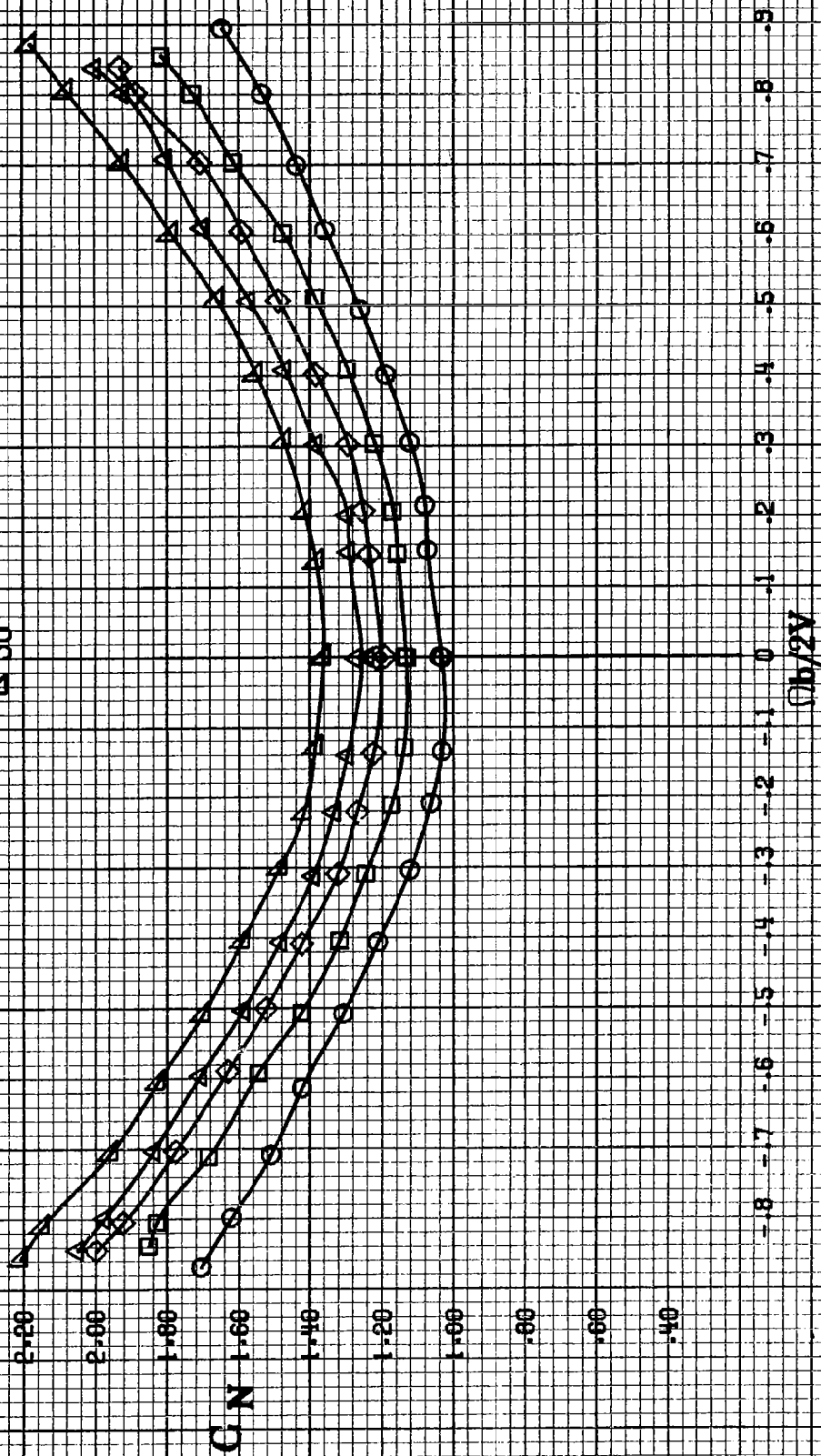


$\alpha$ , deg  
 0 10 20 25 30 35

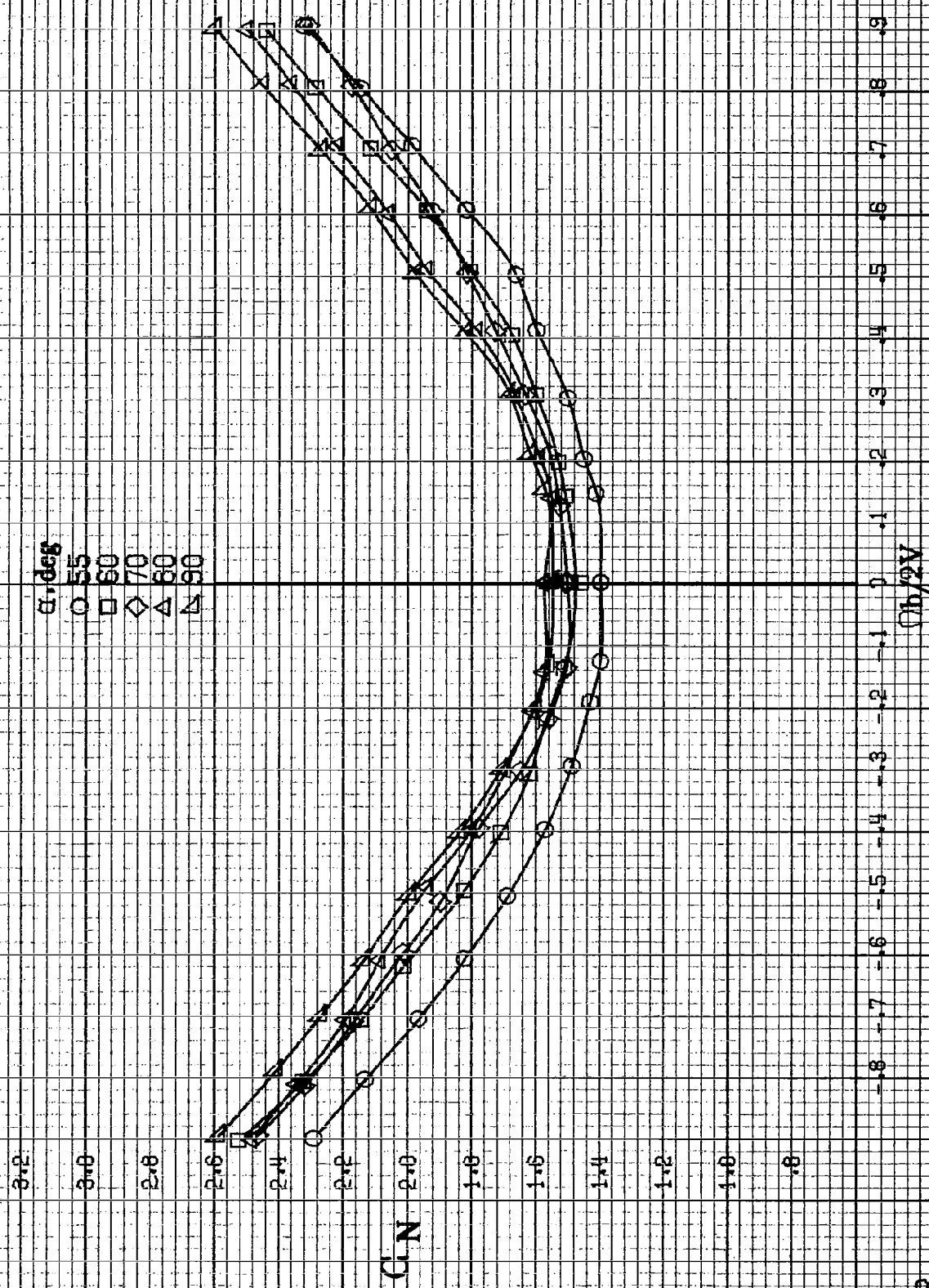


(b)  $\alpha = 18$  to  $35$  deg,  $SR = 182.9$  cm (72 in).  
 Figure A16-Continued.

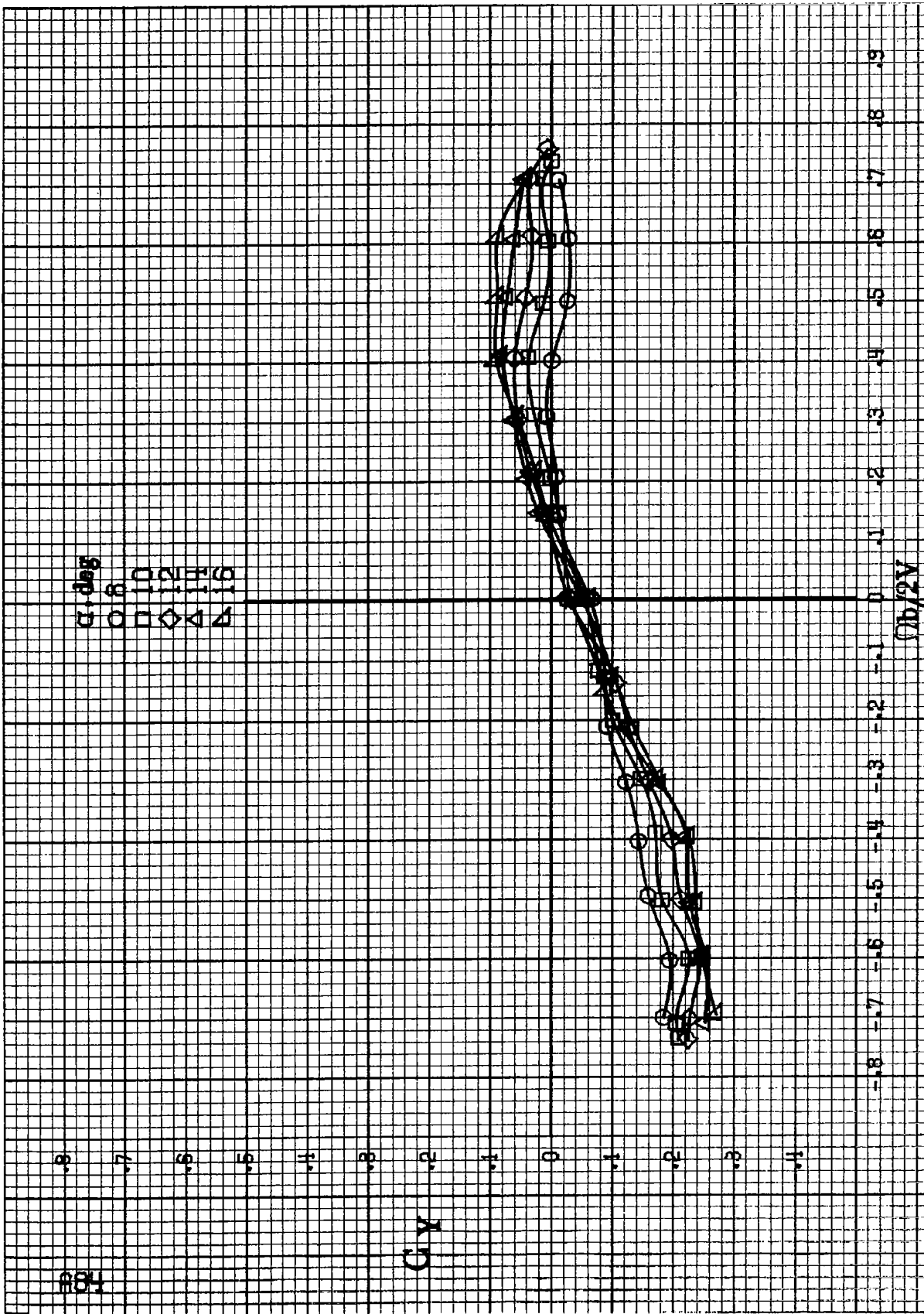
$\sigma, \text{deg}$   
 ○ 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▲ 50



(c)  $\sigma = 30$  to  $50^\circ$ ,  $SR = 0$ .  
 Figure A16-Continued.

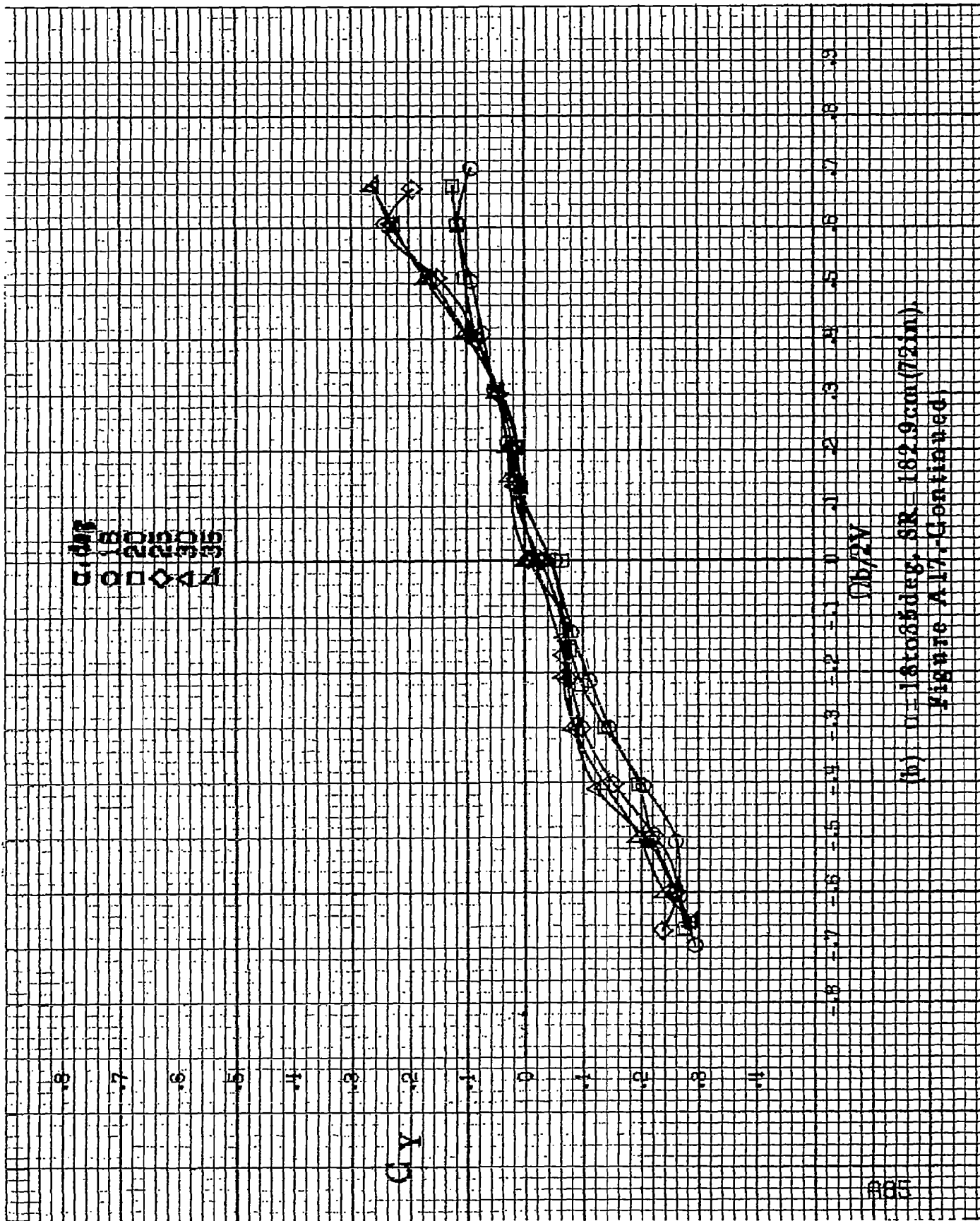


(d)  $\Omega = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A16.-Concluded.



(a)  $\alpha = 8$  to  $16^\circ$ ,  $SR = 182.9 \text{ cm (72 in.)}$ .  
 Figure A17.-Effect of rotation rate and angle of attack on side-force coefficient for basic configuration.  $\delta_a = 15^\circ$ ,  $\delta_r = 0^\circ$ ,  $\delta_z = 0^\circ$ .





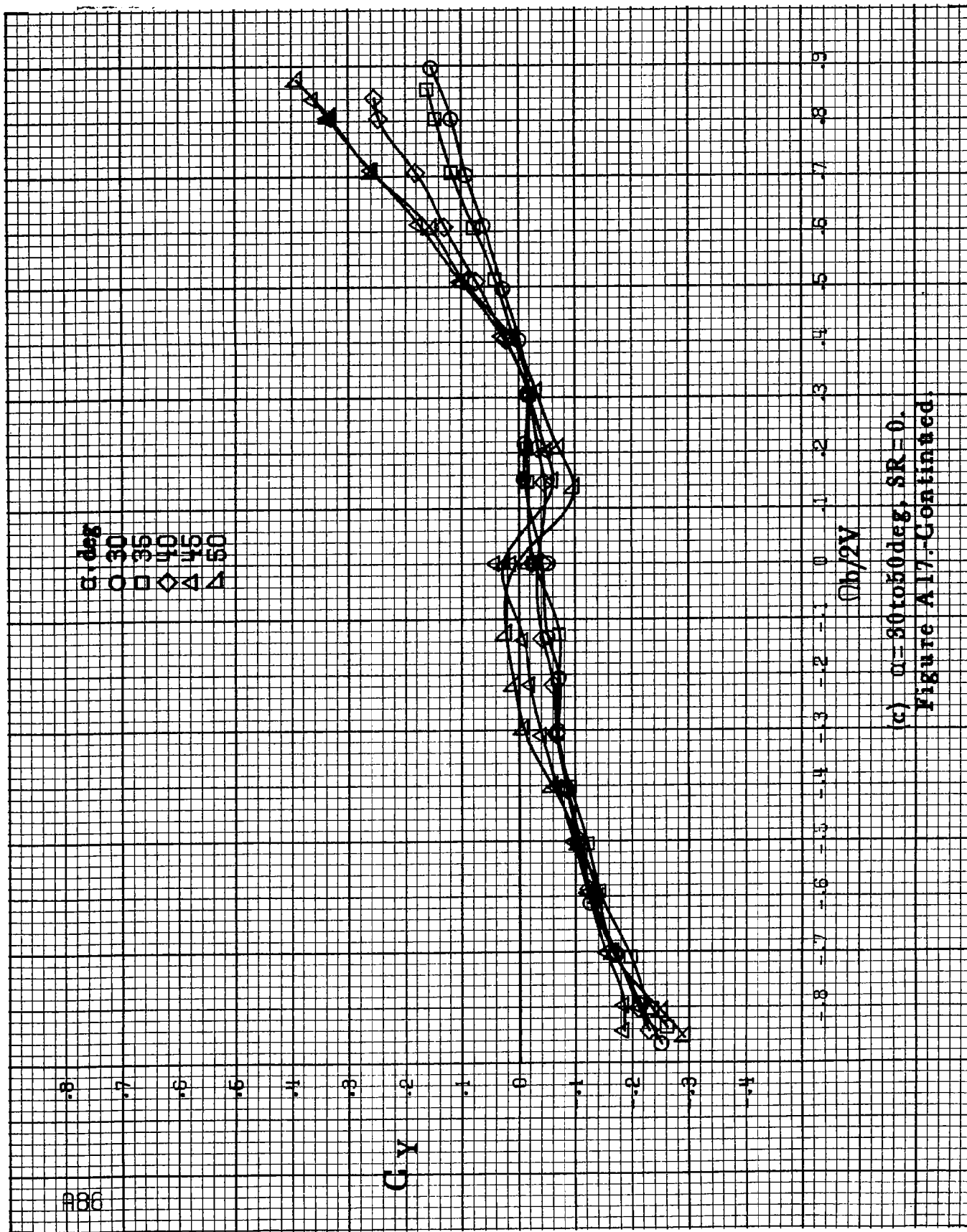
(b)  $U = 16 \text{ to } 84 \text{ deg. SR} = 162.9 \text{ cm (72 in)}$   
Figure A17-Continued

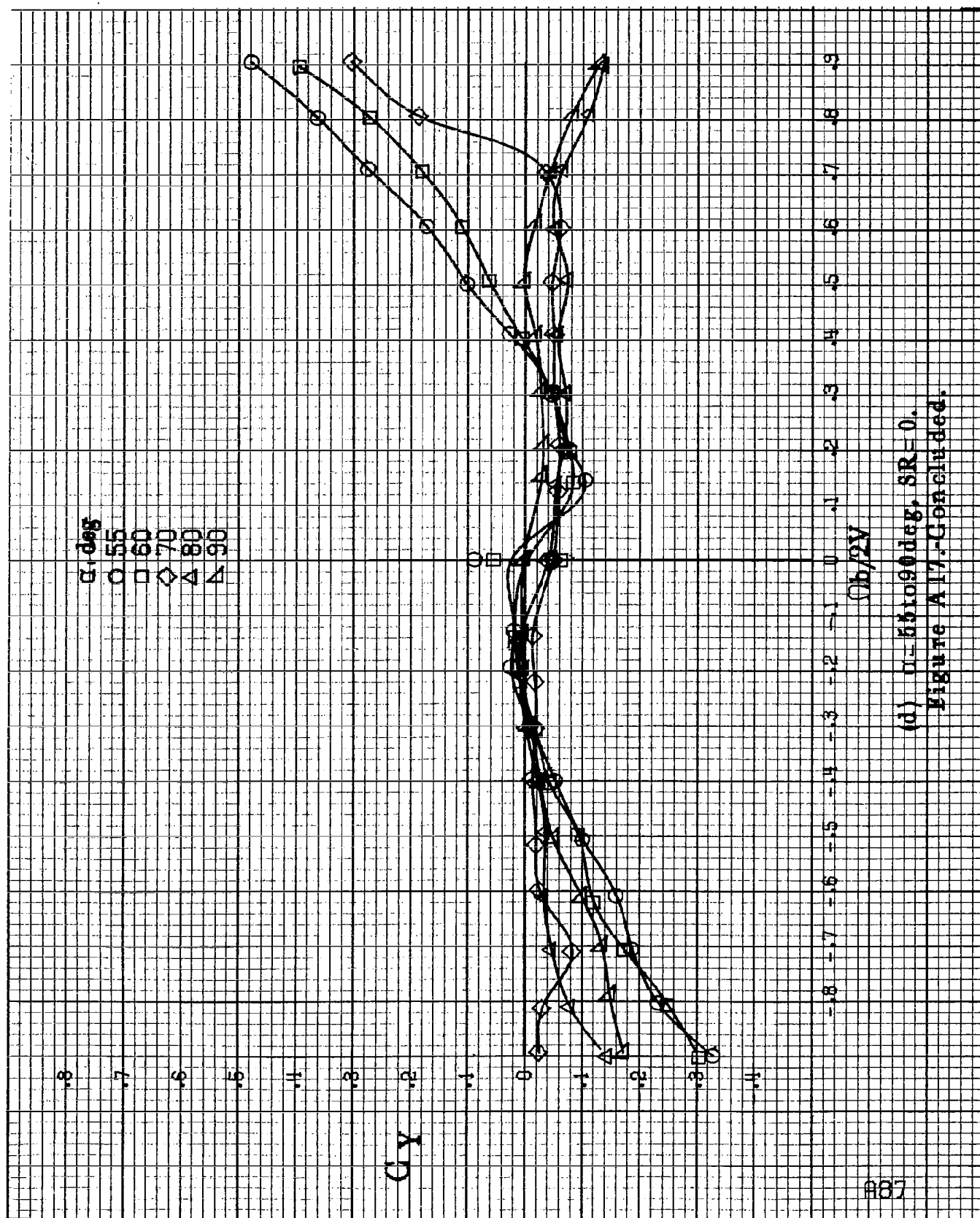
$\alpha, \text{deg}$   
 $\circ$  30  
 $\square$  35  
 $\diamond$  40  
 $\triangle$  45  
 $\nabla$  50

$C_y$

$Ch/2V$

(c)  $\alpha = 30 \text{ to } 50 \text{ deg}$ ,  $SR = 0$ .  
 Figure A17.-Continued.





(d)  $\alpha = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A17-Continued.

$\alpha$ , deg

0°

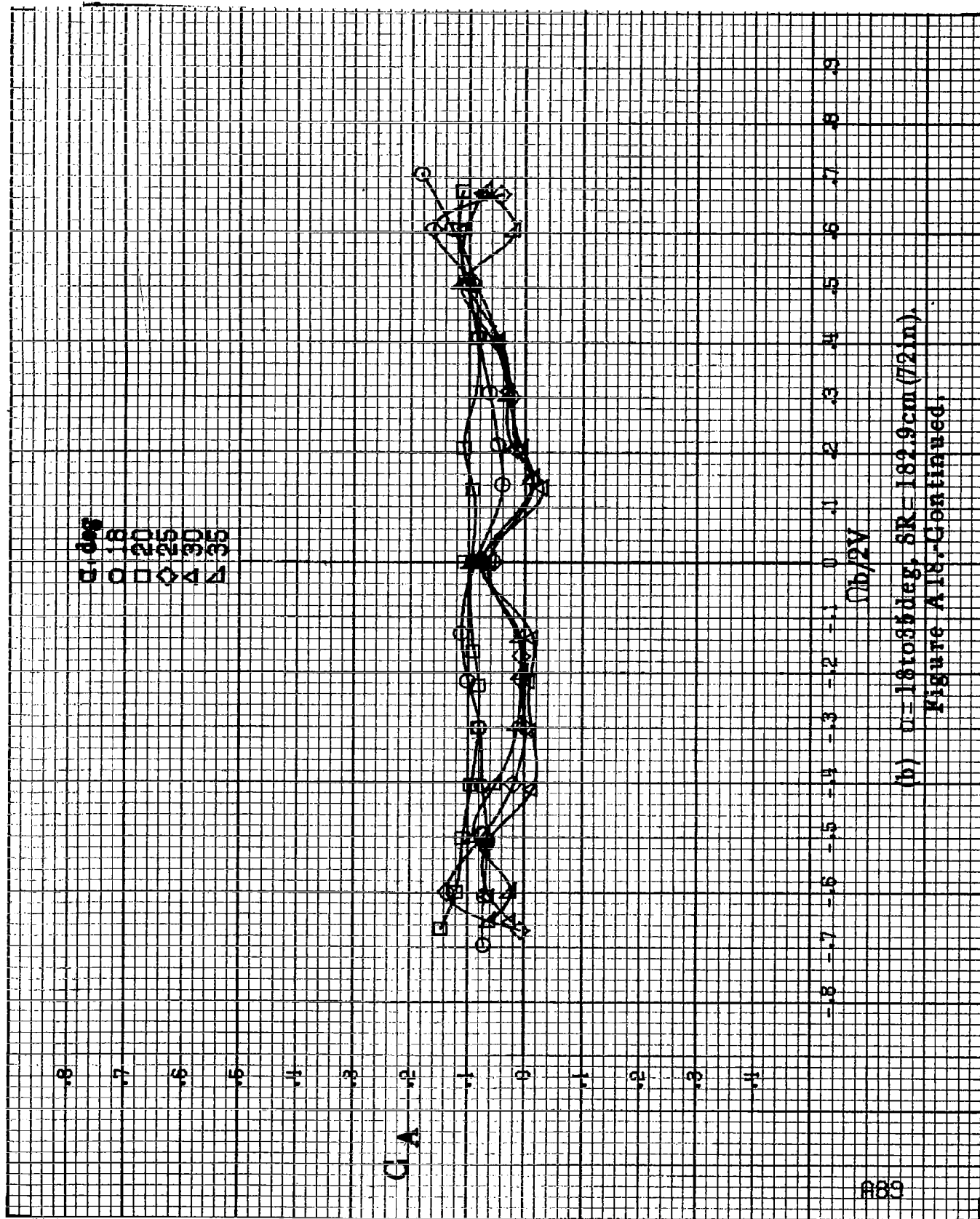
10°

12°

14°

16°

 $C_A$  $\rho b/2V$ (a)  $\alpha = 8 \pm 16^\circ$ ,  $SR = 182.9 \text{ cm (72 in.)}$ .Figure A18. Effect of rotation rate and angle of attack on axial-force coefficient for basic configuration.  $\delta_a = -15^\circ$ ,  $\delta_n = 0^\circ$ ,  $\delta_r = -25^\circ$ ,  $\beta = 0^\circ$ .



(b)  $\alpha = 18$  to  $35$  deg, SR = 182.9 cm (72 in).  
Figure A18.-Continued.

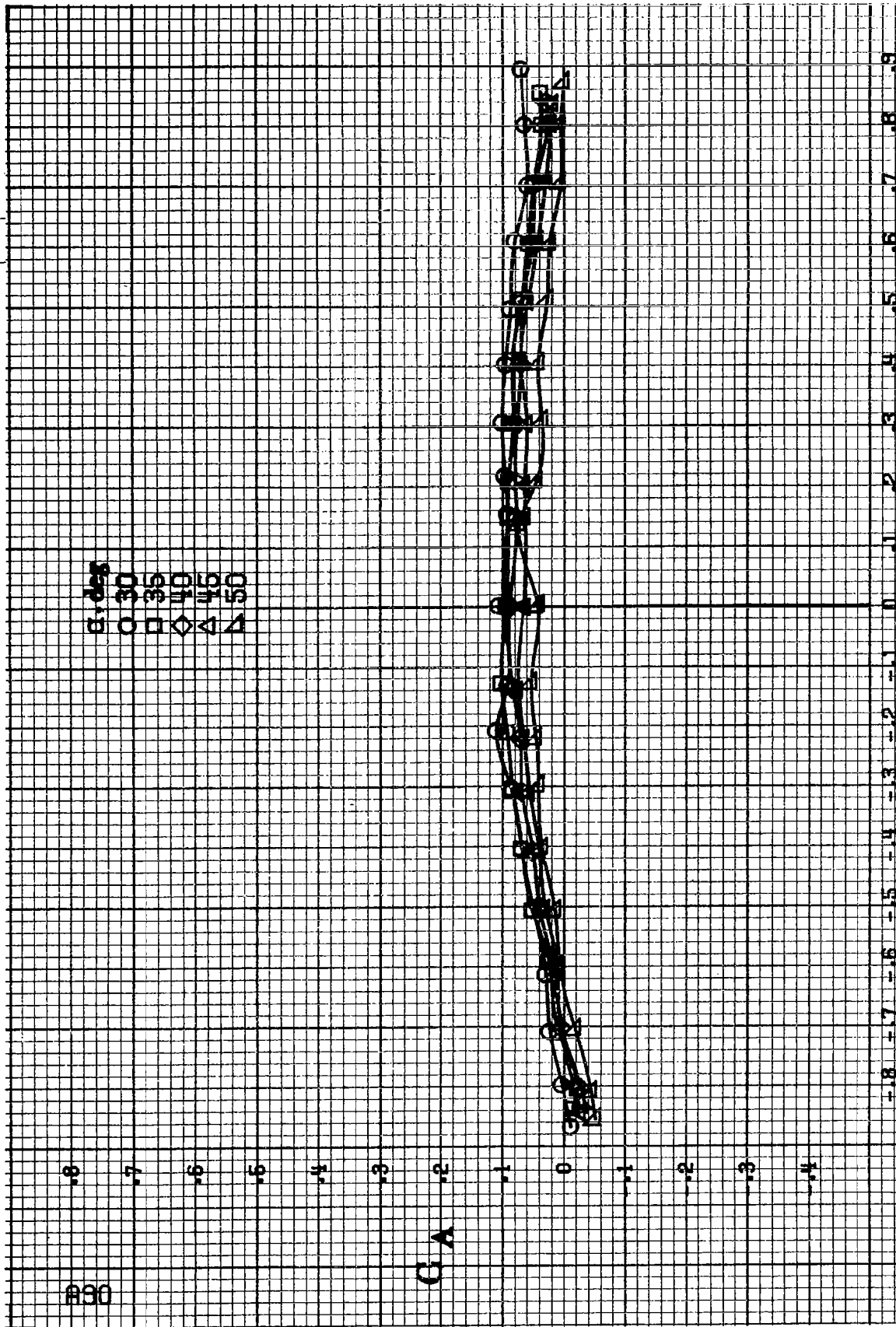
830

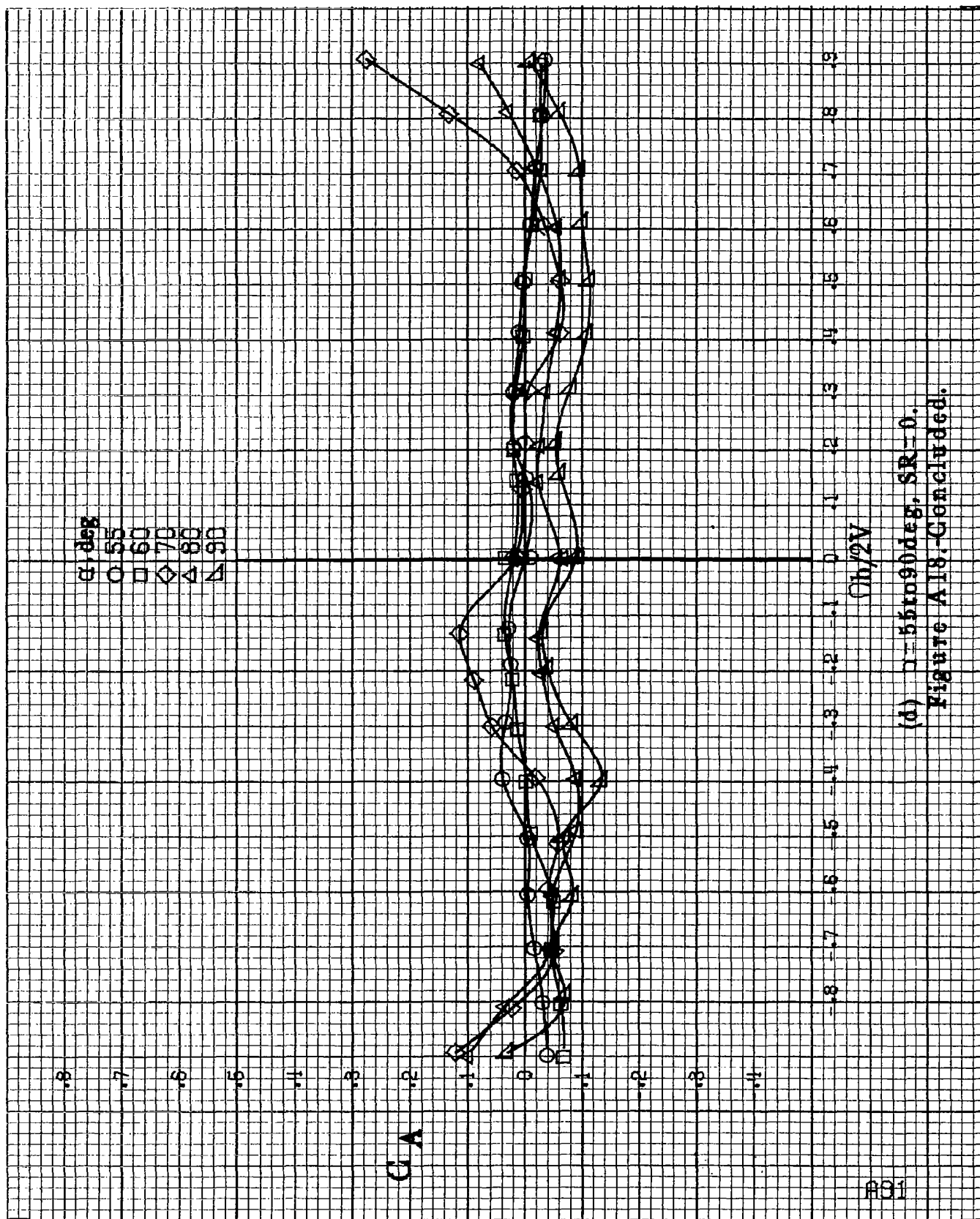
$\alpha, \text{deg}$   
 O 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▲ 50

C A

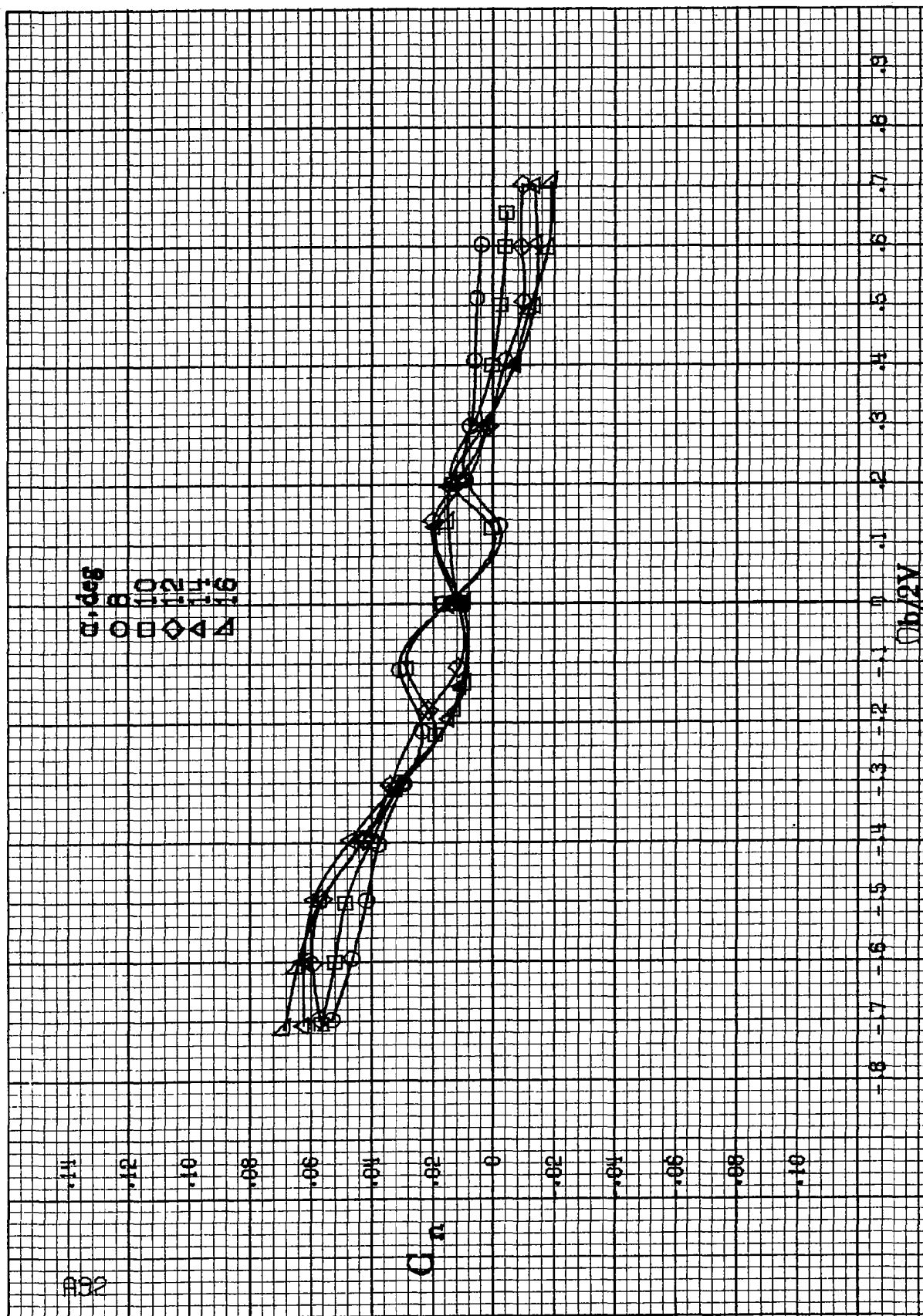
$\Omega b/2V$

(a)  $\Omega = 80$  to  $50 \text{ deg}$ ,  $SR = 0$ .  
 Figure A18-Continued.

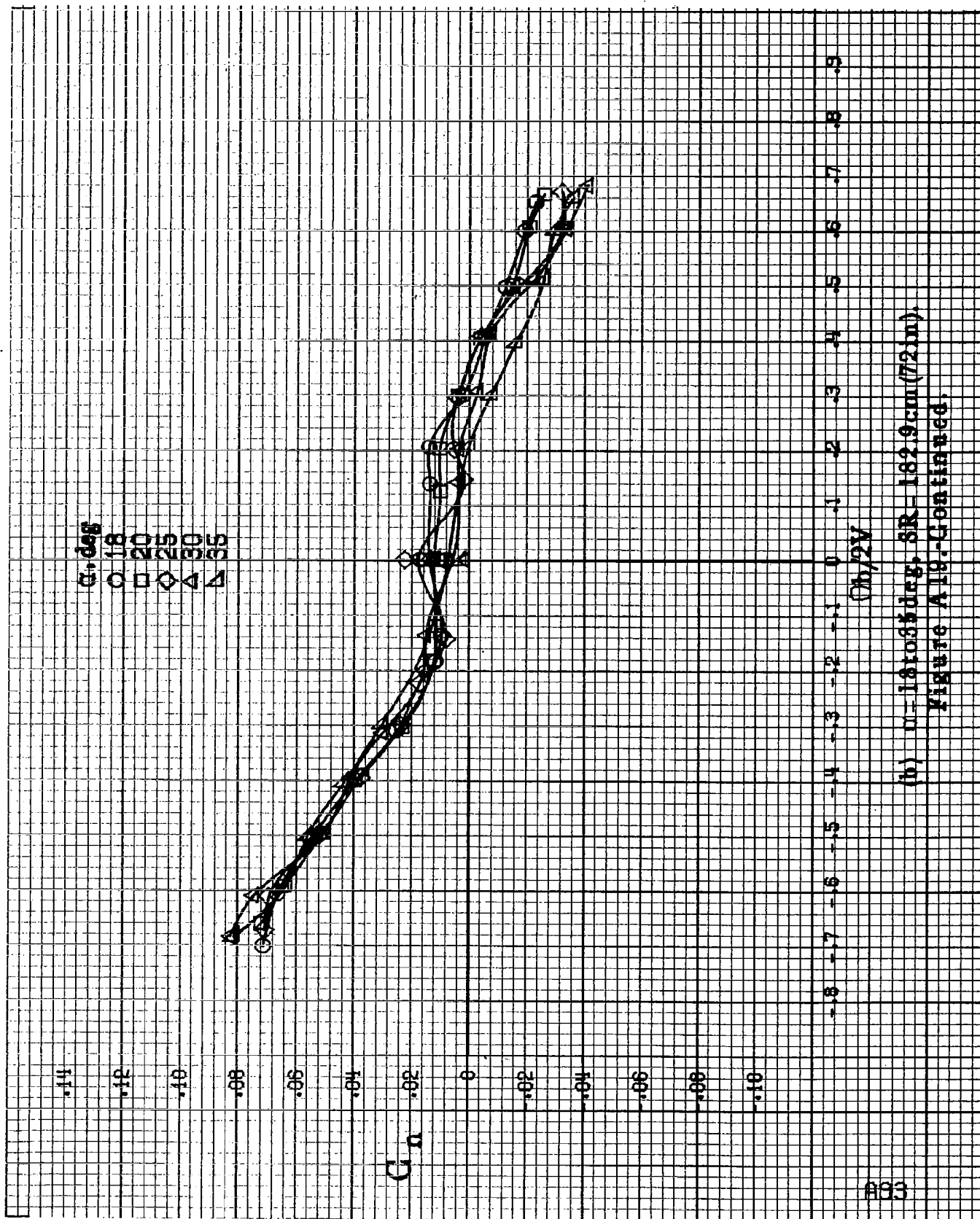




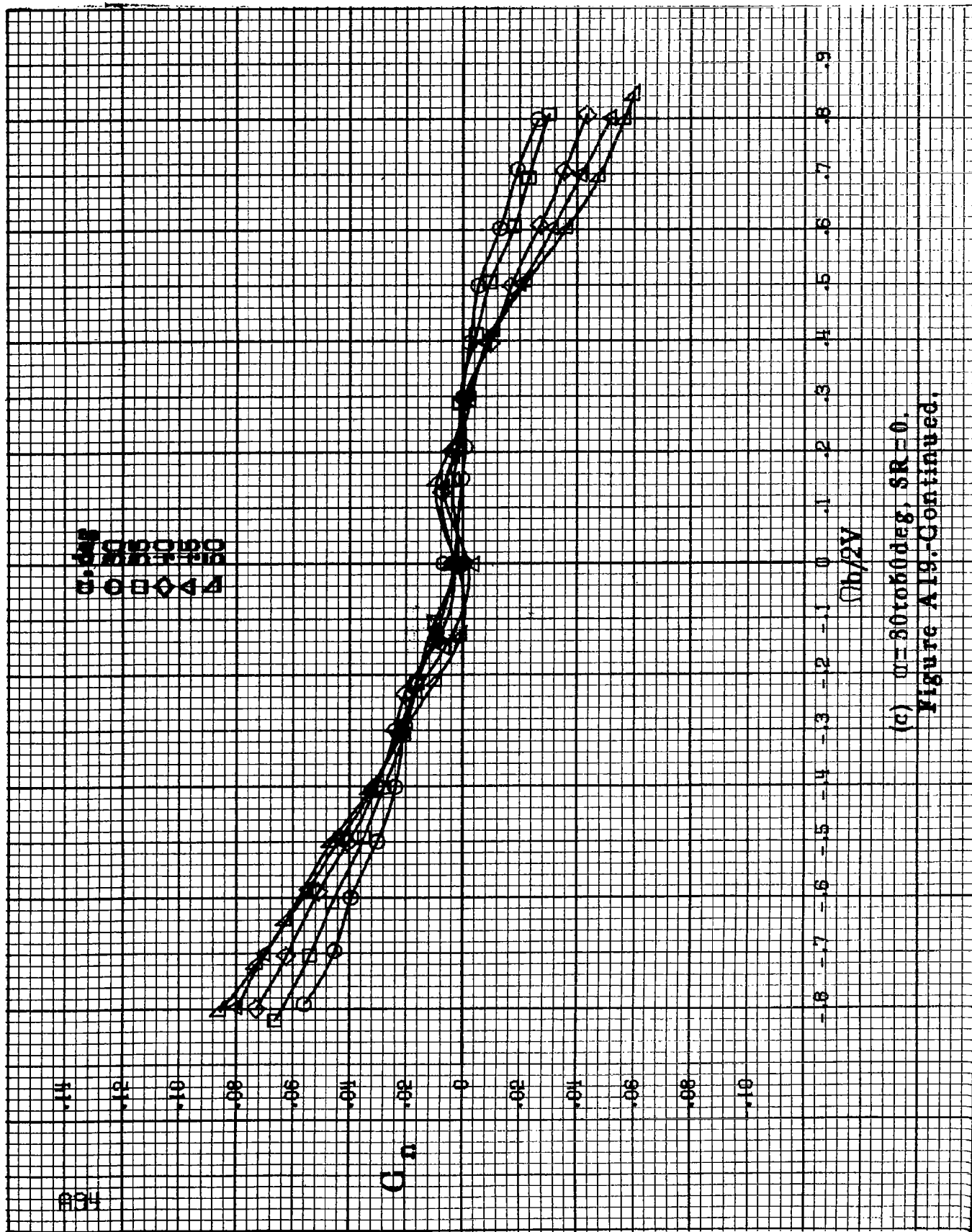
(d)  $\alpha = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A18.-Concluded.

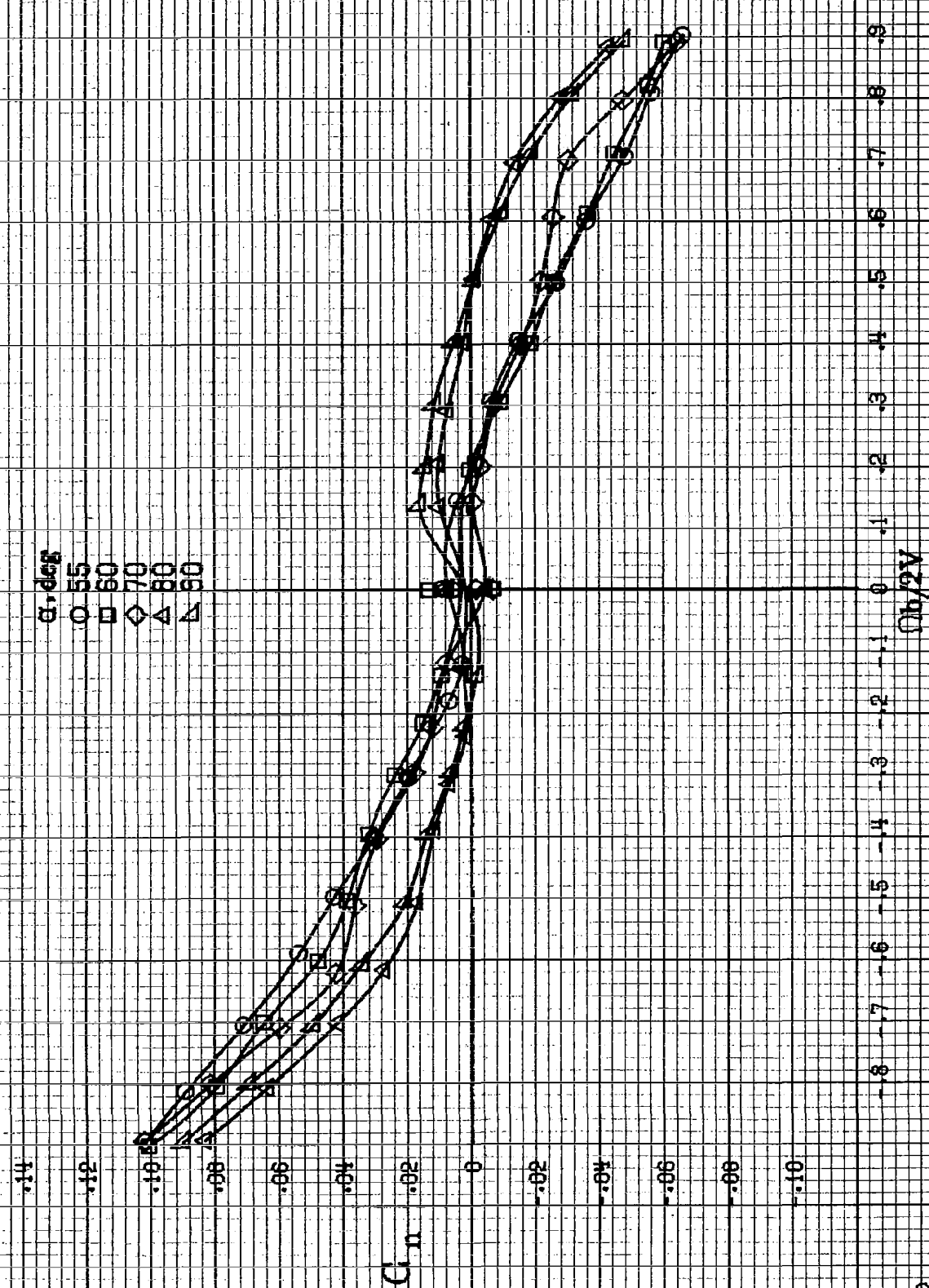




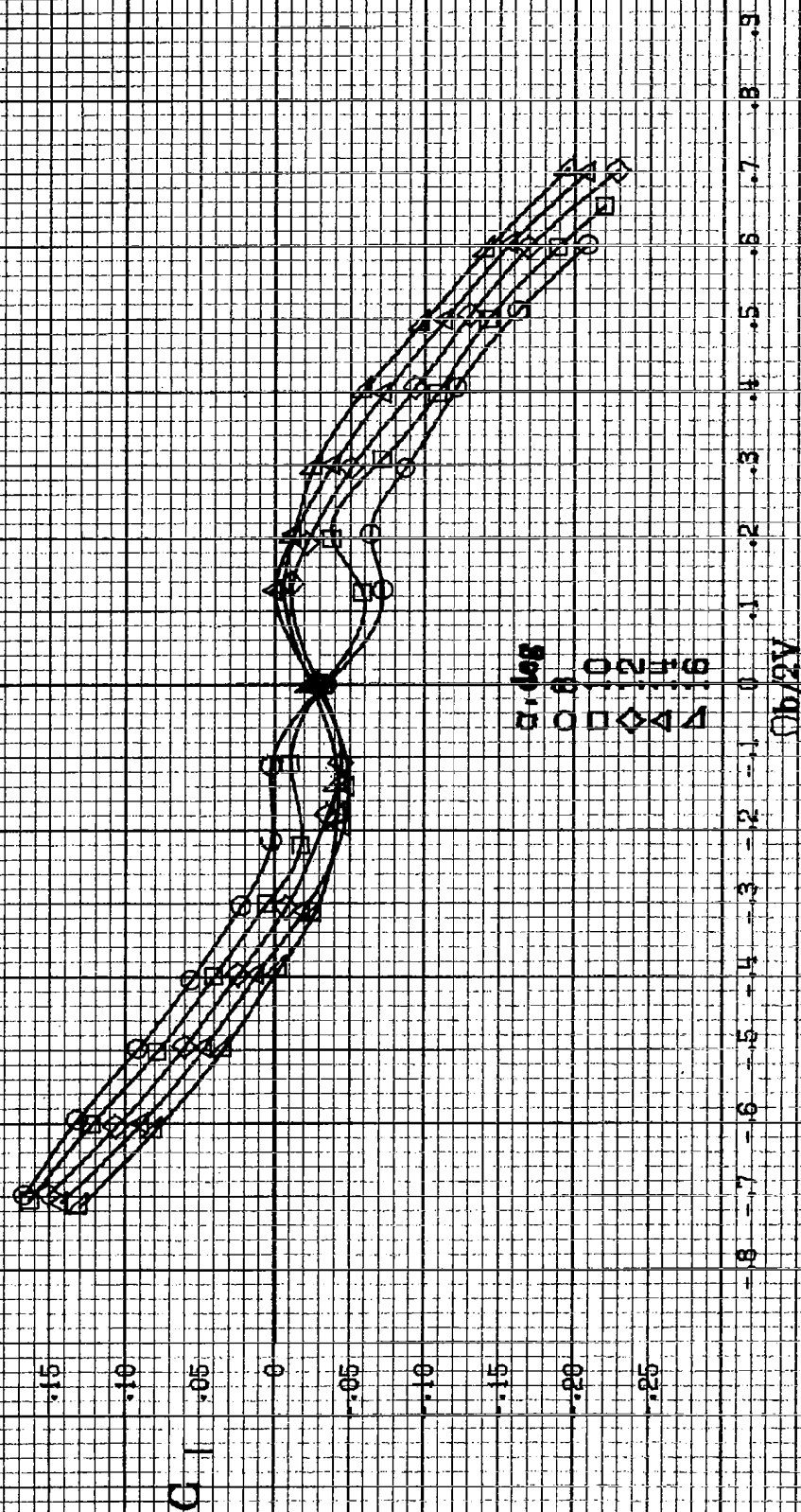


(b)  $\alpha = 18$  to  $35$  deg, SR-162.9 cm (72 in).  
Figure A19-Continued.

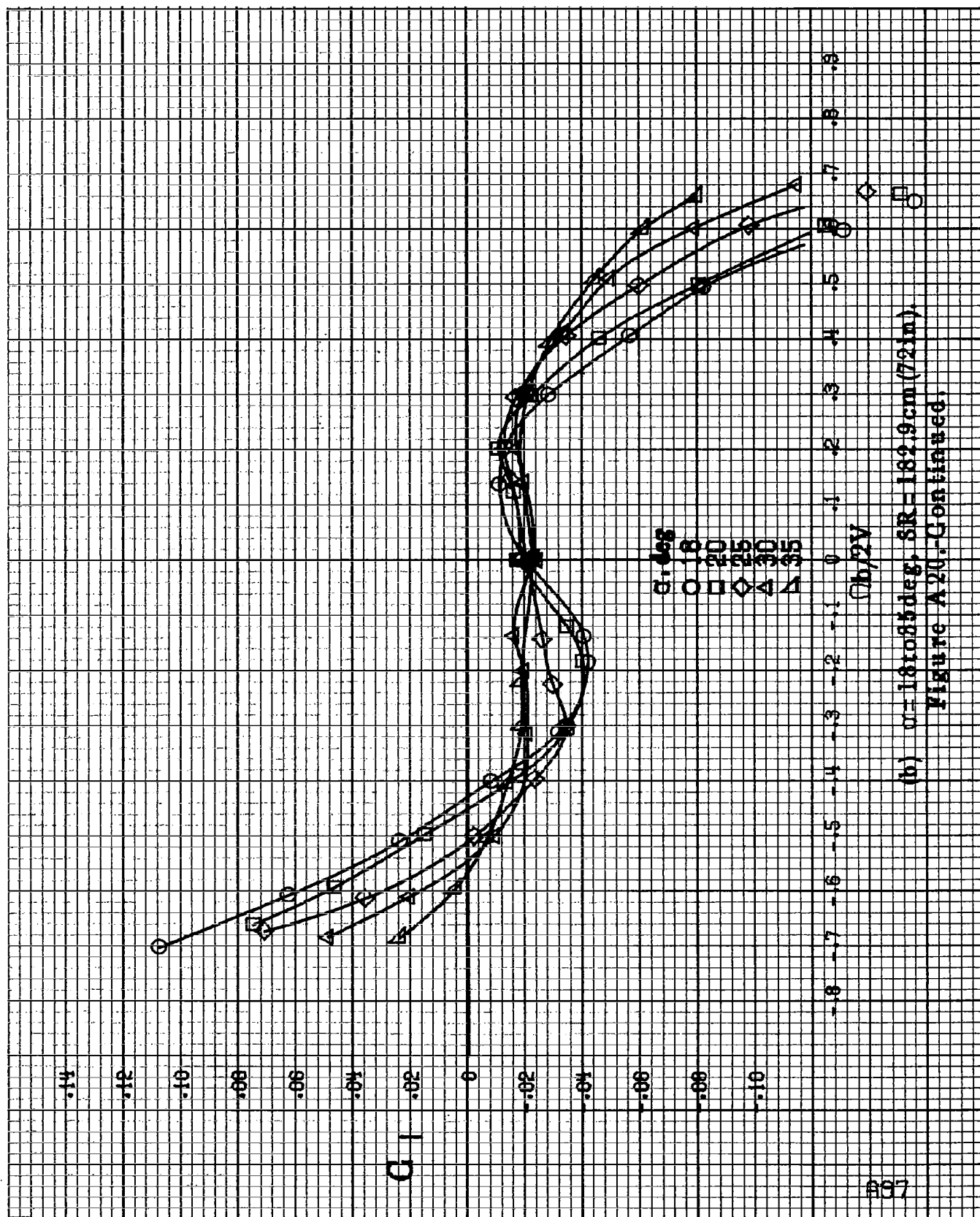




(d)  $\alpha=55$  to  $90^\circ$ ,  $SR=0$ .  
Figure A19-Continued.

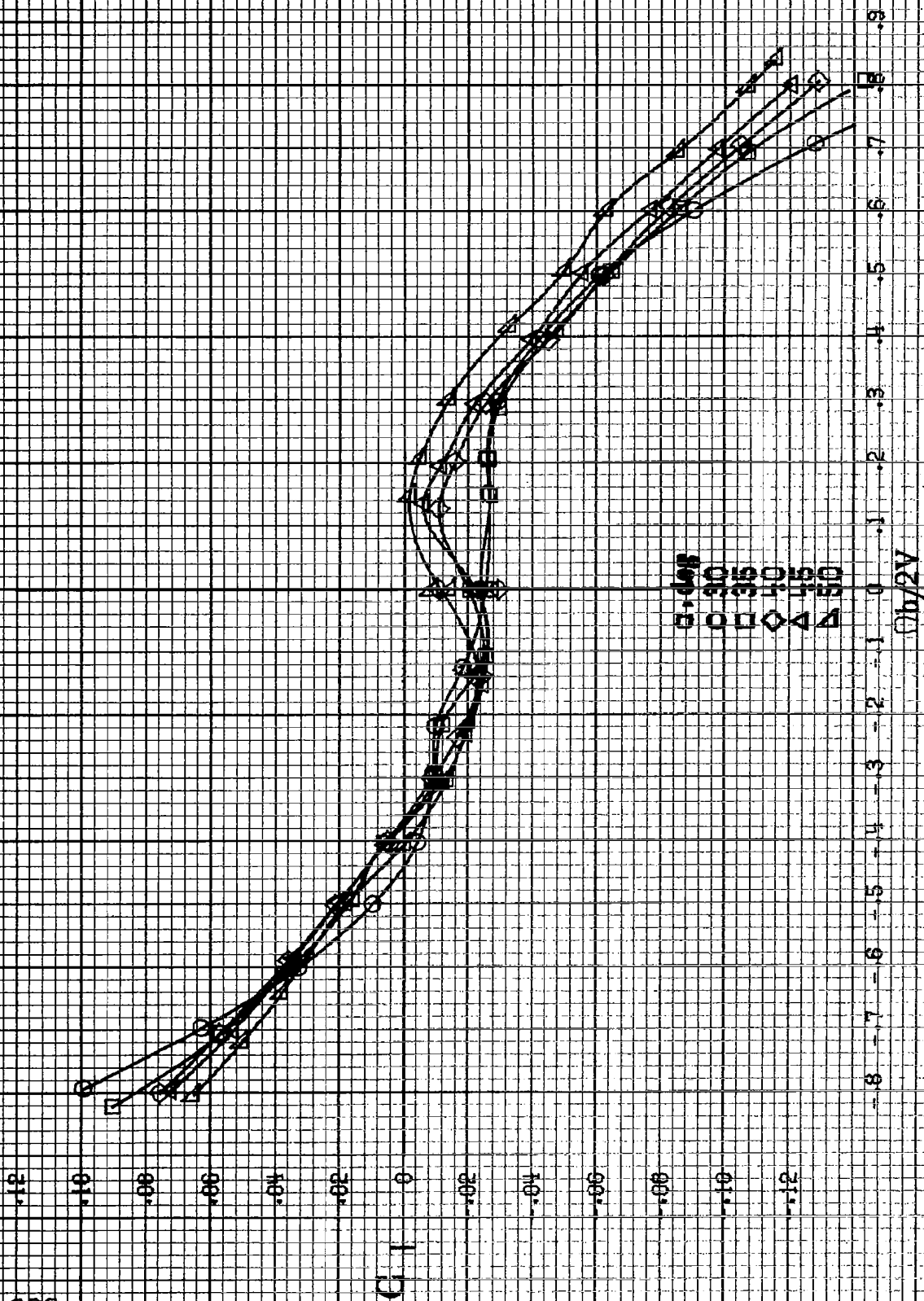


(a)  $\alpha = 8$  to  $16$  deg,  $SR = 182.9$  cm (72 in).  
 Figure A20. Effect of rotation rate and angle of attack on rolling-moment coefficient for basic configuration.  $\delta_a = 15^\circ$ ,  $\delta_s = 15.0^\circ$ ,  $\delta_r = 25^\circ$ ,  $\delta = 0^\circ$ .

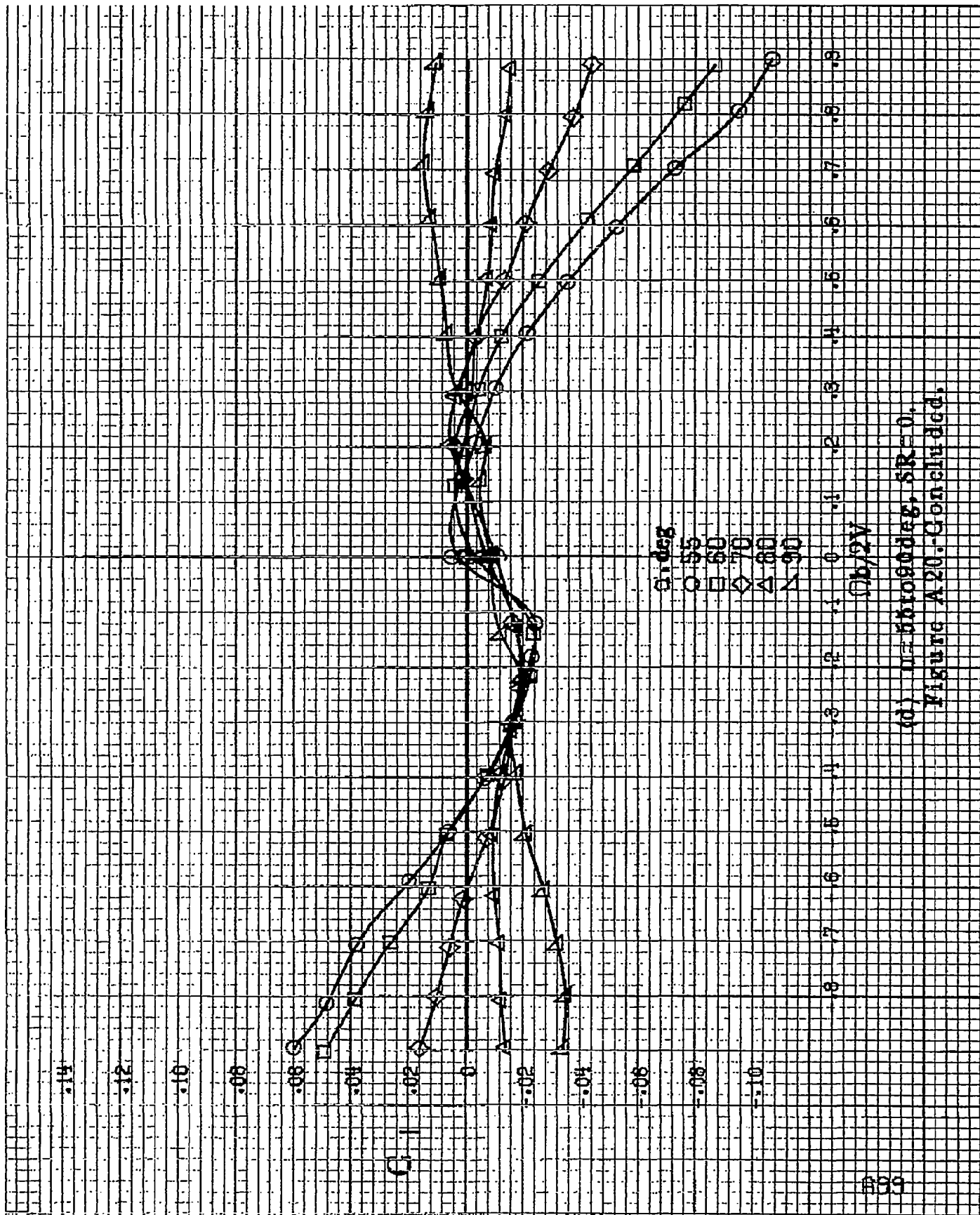


(b)  $\alpha = 18$  to  $35^\circ$ ,  $SR = 162.9 \text{ cm (72 in.)}$ .

Figure A20.-Continued.

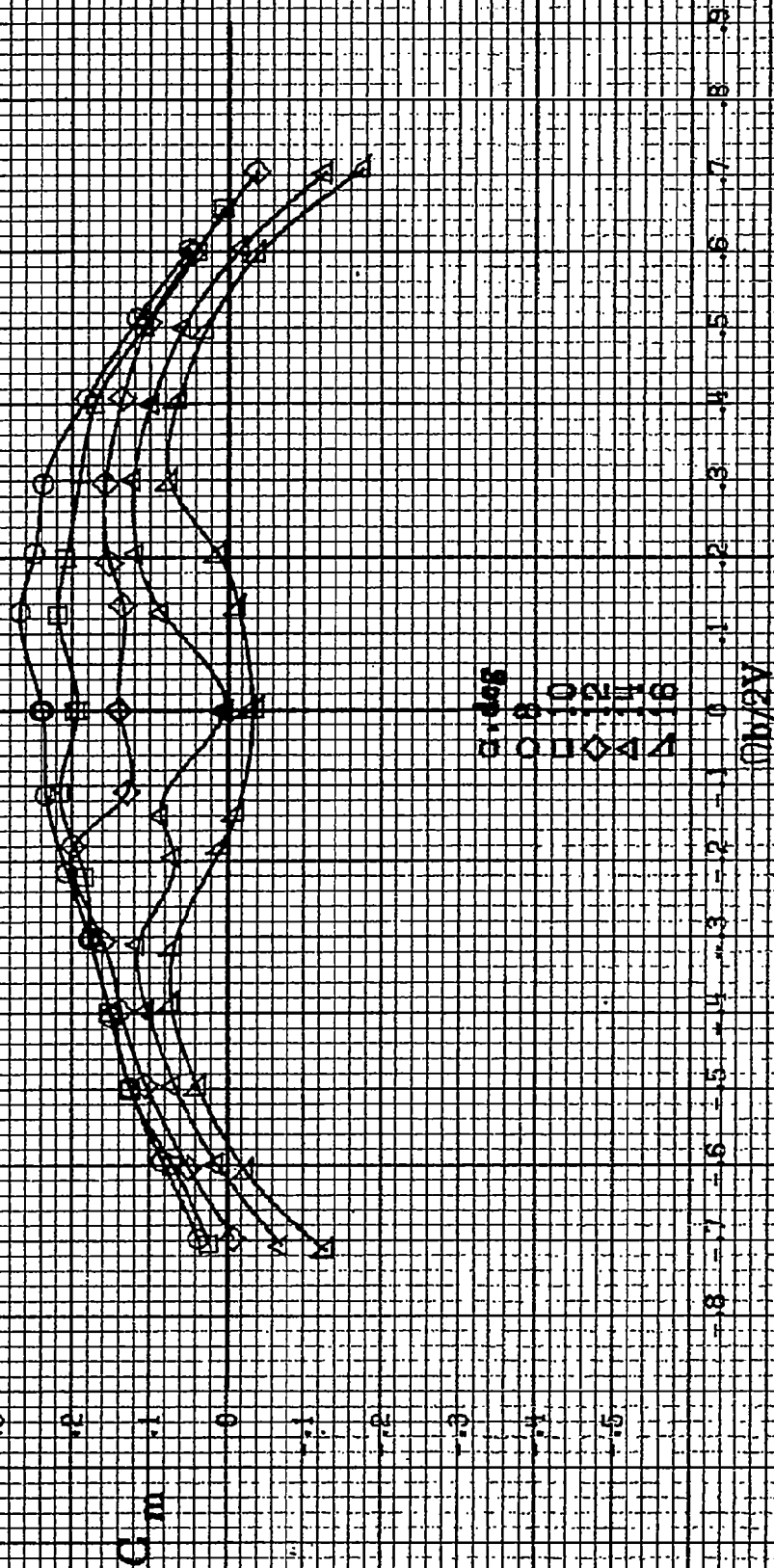


(c)  $\alpha = 30$  to  $50$  deg,  $SR = 0$ .  
Figure A20.-Continued.



(d)  $\mu=55$  to  $90$  deg,  $SR=0$ .  
Figure A20.-Continued.

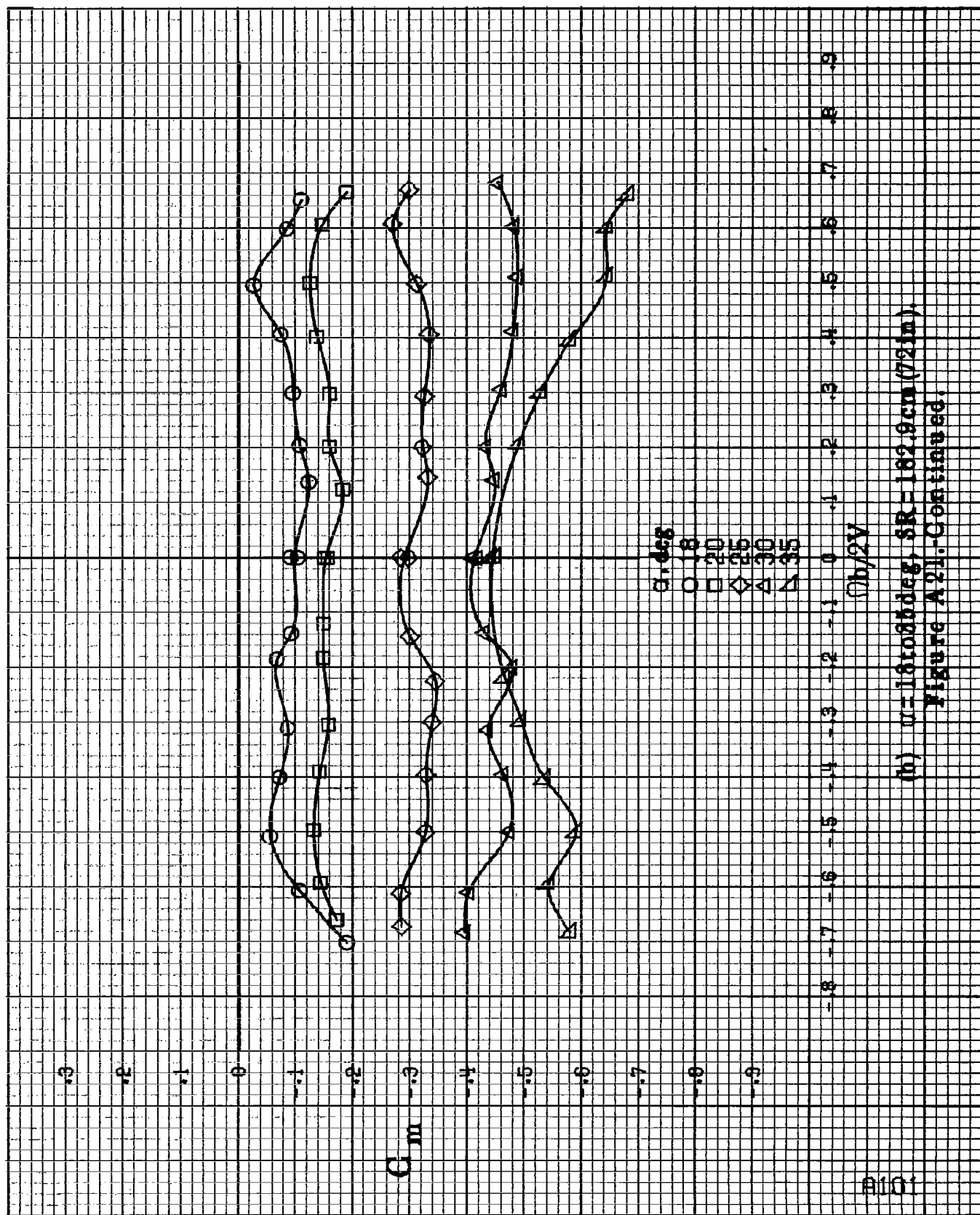
0100



(a)  $\alpha = 8$  to  $16$  deg,  $SR = 182.9$  cm (72 in).

Figure A21. Effect of rotation rate and angle of attack on pitching moment coefficient for basic configuration.  $\delta_1 = 15^\circ$ ,  $\delta_2 = 15.0^\circ$ ,  $\delta_3 = 25^\circ$ ,  $\delta_4 = 0^\circ$ .





(b)  $\mu=18$  to  $35^\circ$ ,  $SR=182.9\text{ cm (72 in.)}$ .  
Figure A21.-Continued.

#102

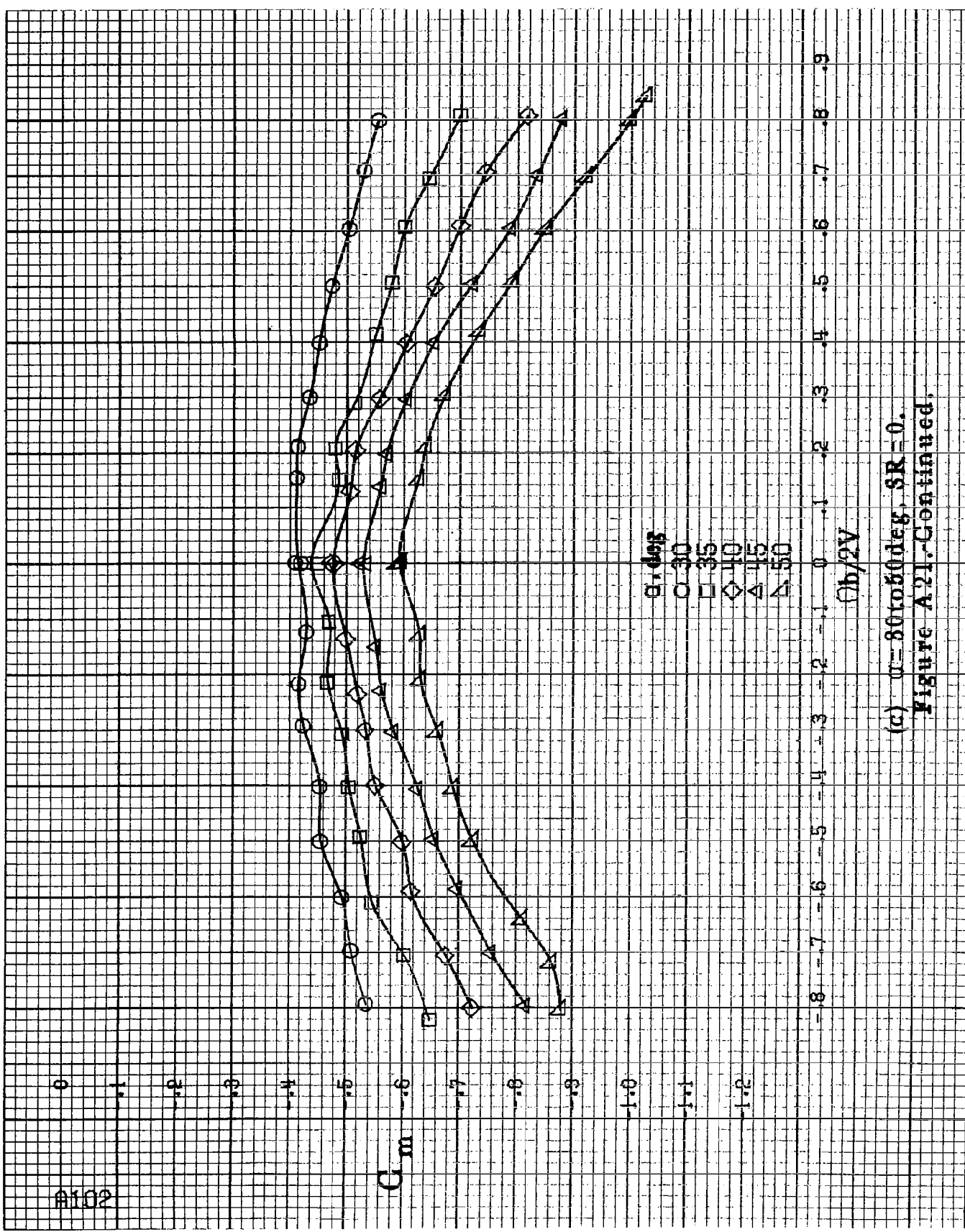
$C_m$

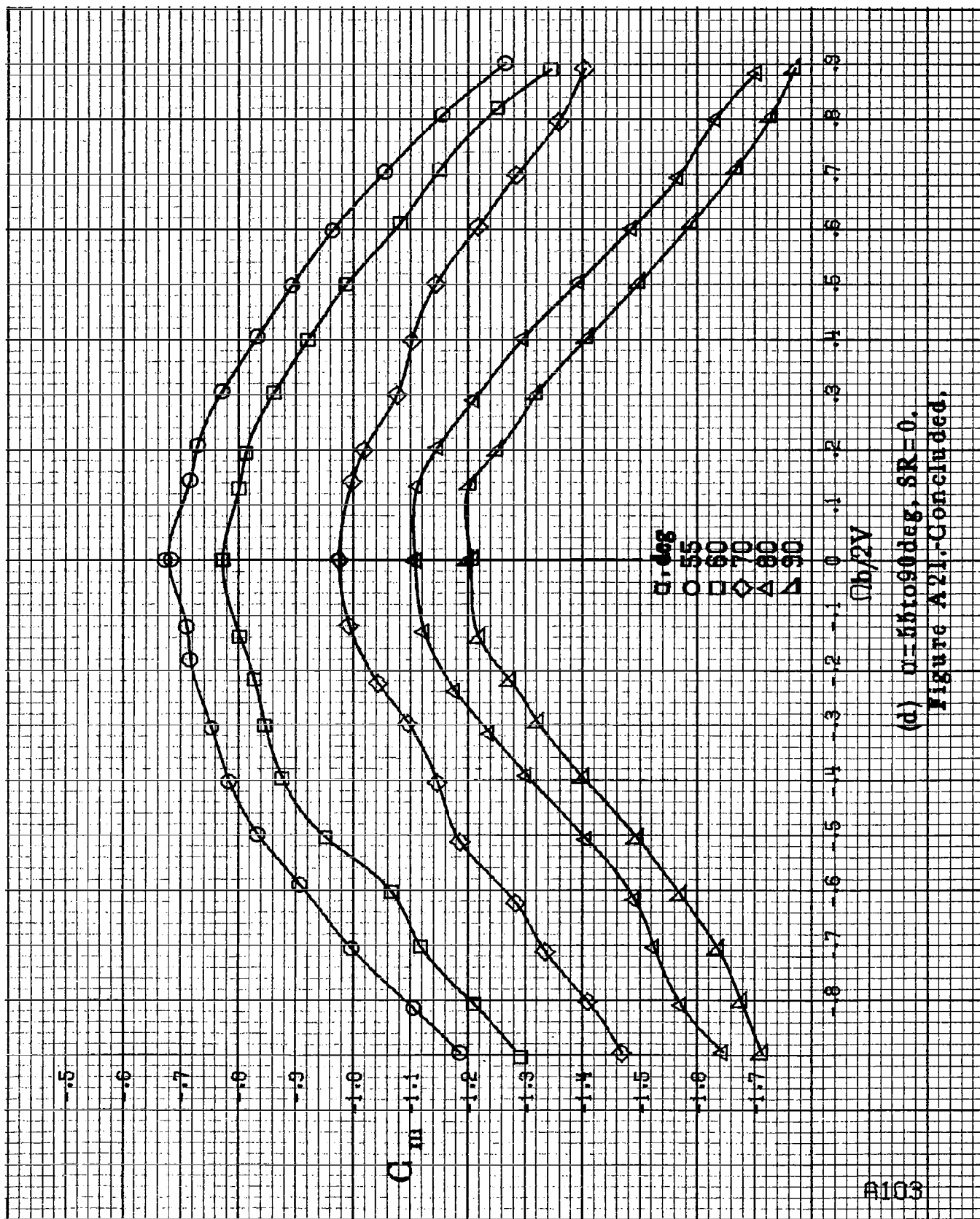
$\theta$ , deg

- 30
- 35
- ◇ 40
- △ 45
- ▽ 50

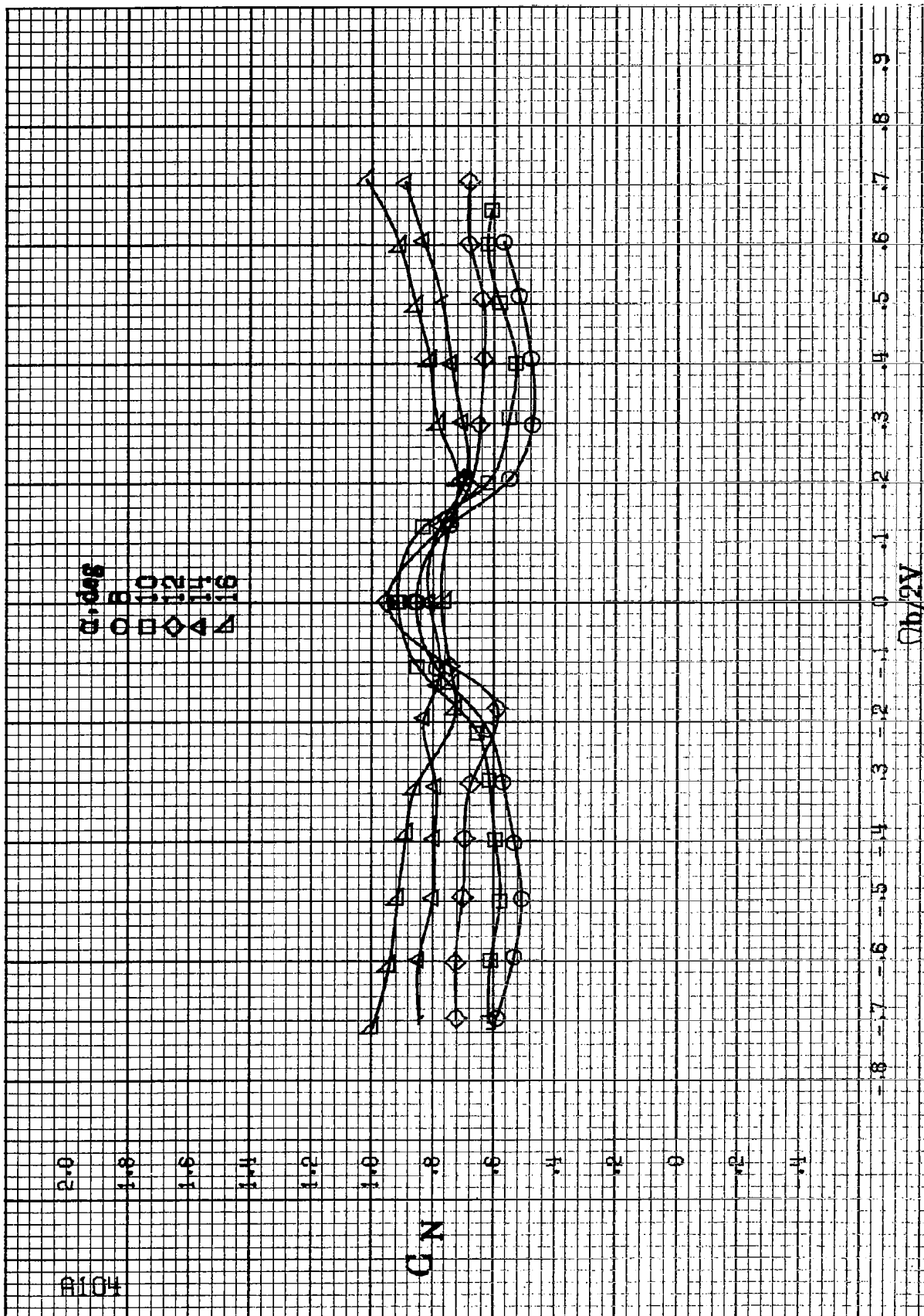
$C_b/2V$

(c)  $\alpha = 80$  to  $50$  deg,  $SR = 0$ .  
Figure A.21.-Continued.





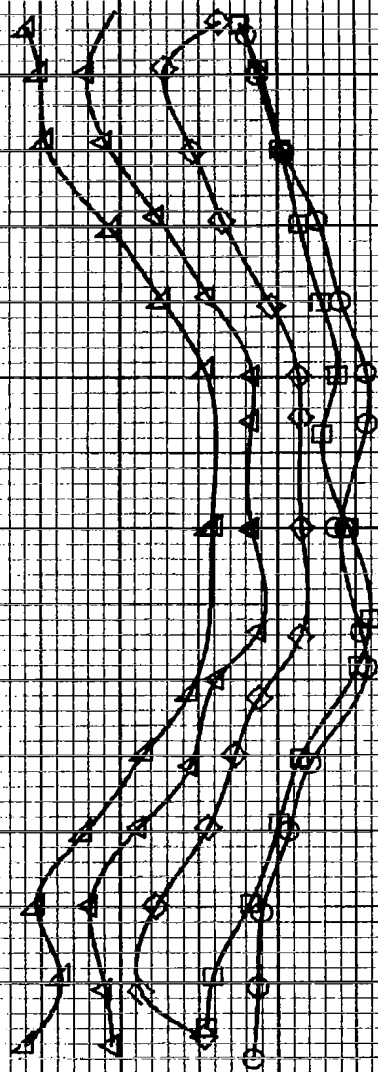
(d)  $\alpha = 60$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A21-Continued.



(a)  $\alpha = 8$  to  $16^\circ$ ,  $SR = 182.9 \text{ cm (72 in.)}$ .

Figure A22. Effect of rotation rate and angle of attack on normal force coefficient for basic configuration.  $\phi_a = -15^\circ$ ,  $\phi_r = -15.0^\circ$ ,  $\phi_f = -25^\circ$ ,  $\beta = 0^\circ$ .

$\alpha$ , deg  
 ○ 18  
 □ 20  
 ◇ 25  
 △ 30  
 ▽ 35



(b)  $\alpha=18$  to  $35$  deg,  $SR=182.9$  cm (72 in).  
 Figure A22.-Continued.

A106

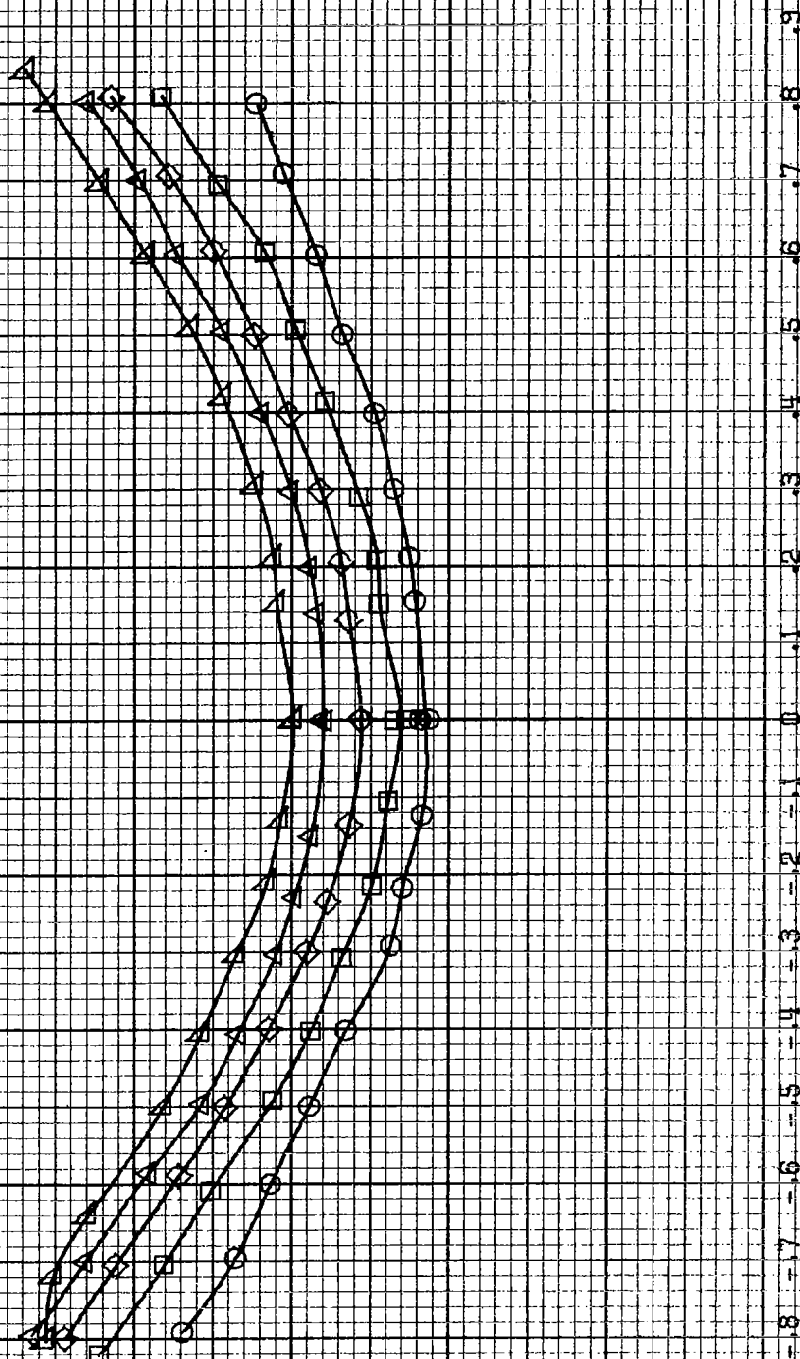
$\alpha$ , deg

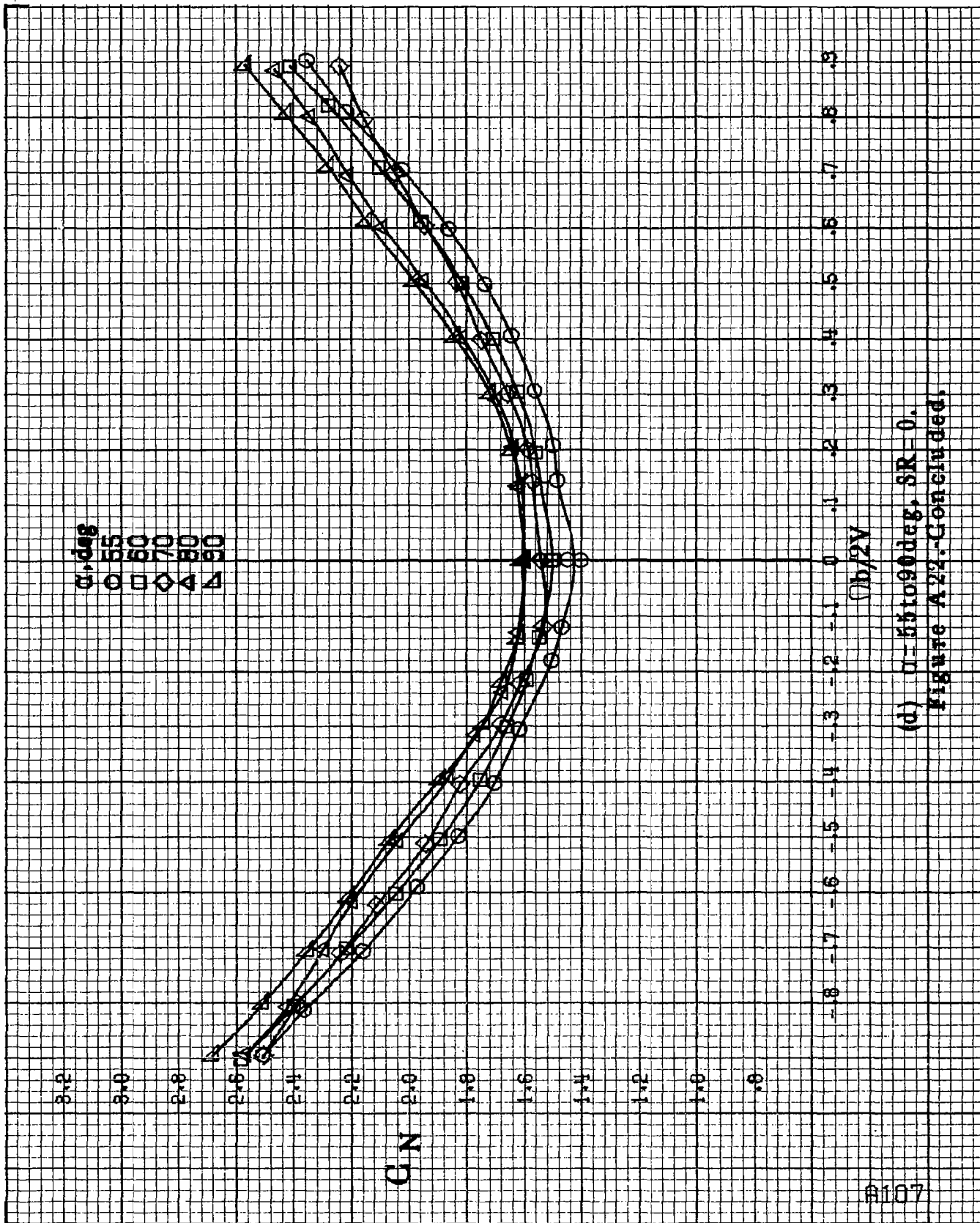
○ 50  
□ 35  
◇ 10  
△ 15  
▽ 50

$G/N$

$\phi h/2V$

(c)  $\alpha = 30$  to  $60$  deg,  $SR = 0$ .  
Figure A22.-Continued.





(d)  $\alpha=55$  to  $90^\circ$  deg,  $SR=0$ .  
Figure A22.-Concluded.

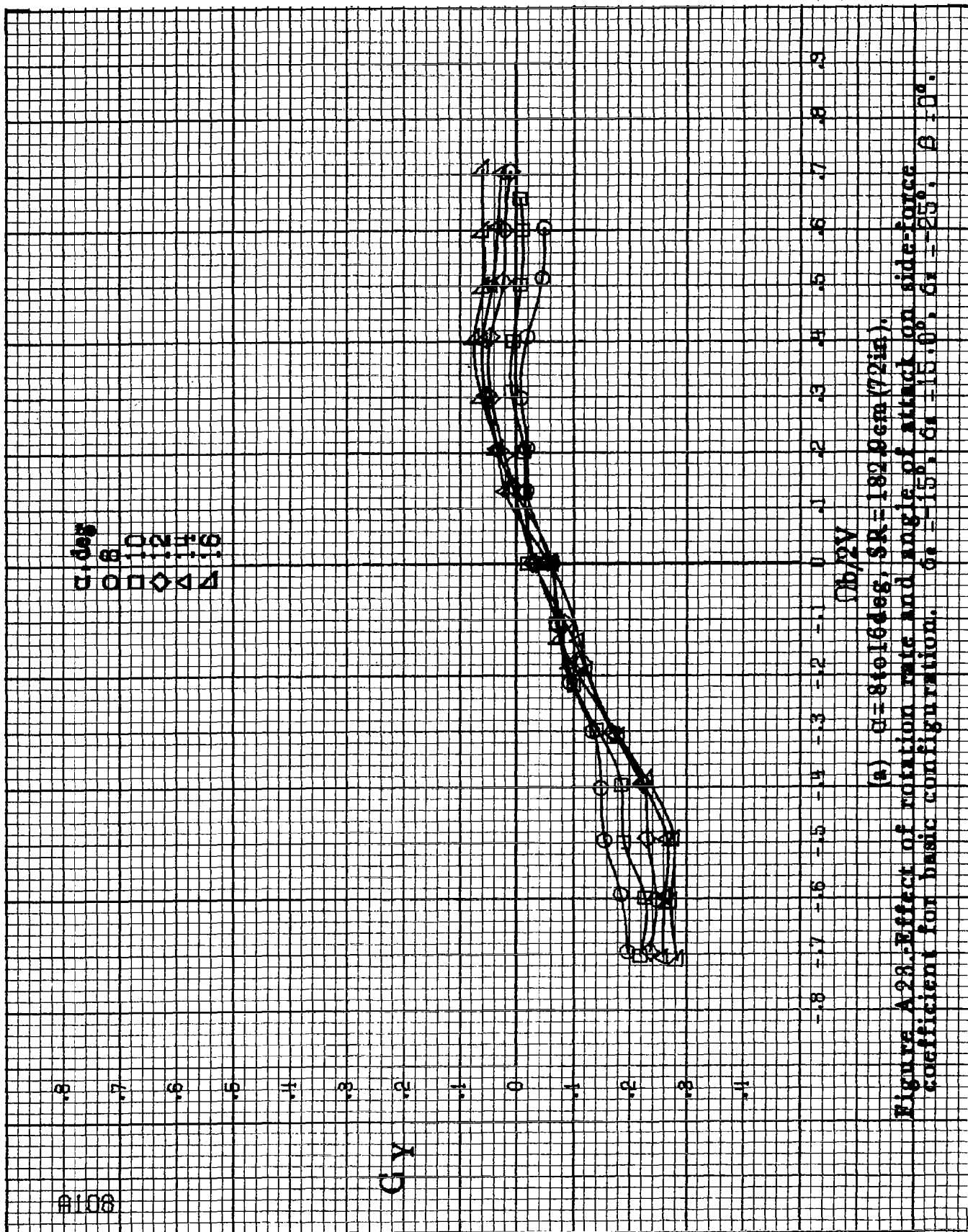


Figure A-28. Effect of rotation rate and angle of attack on side force coefficient for basic configuration.  $\alpha_1 = 15^\circ$ ,  $\alpha_2 = 15.0^\circ$ ,  $\alpha_3 = 25^\circ$ ,  $\beta = 0^\circ$ .





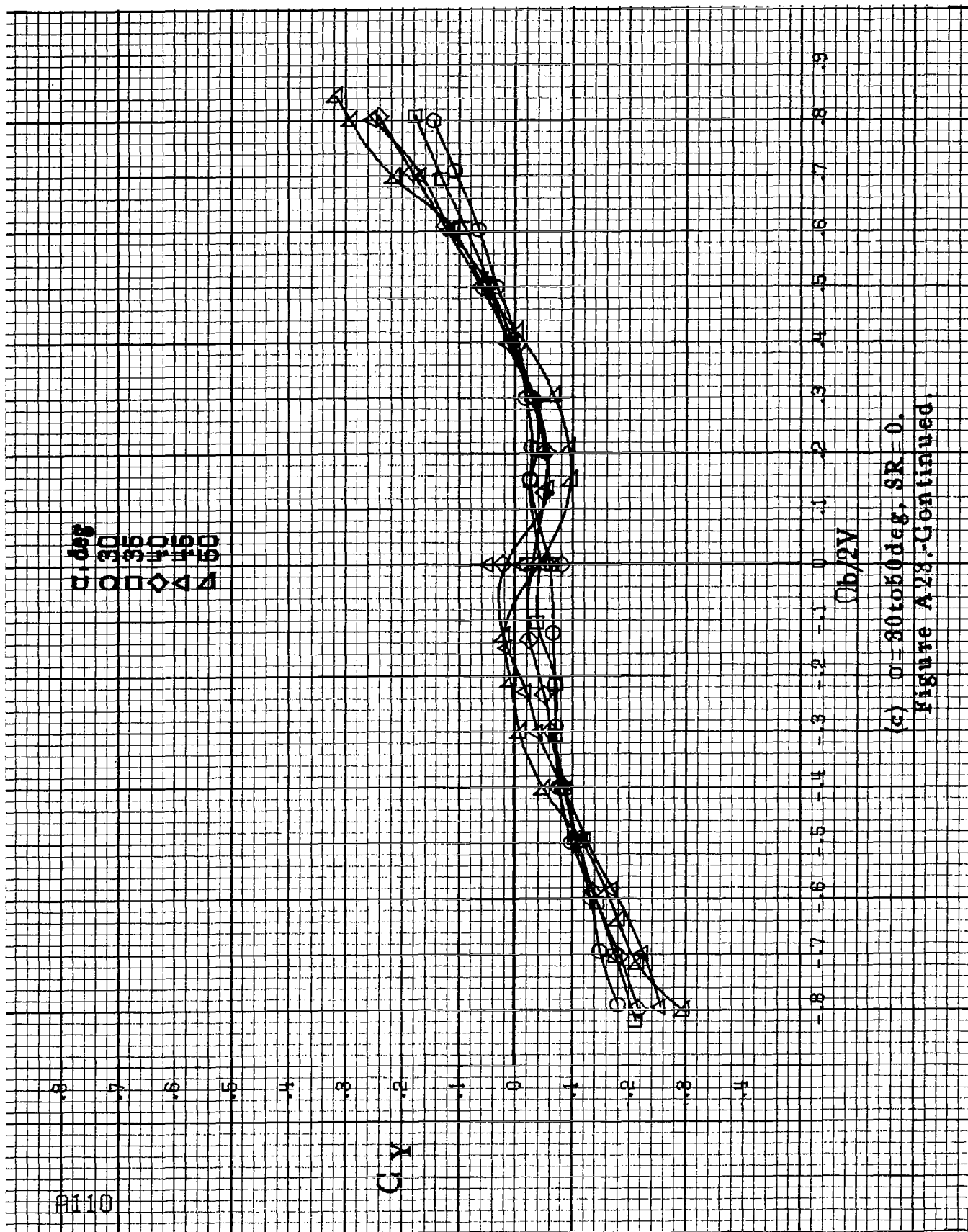
0110

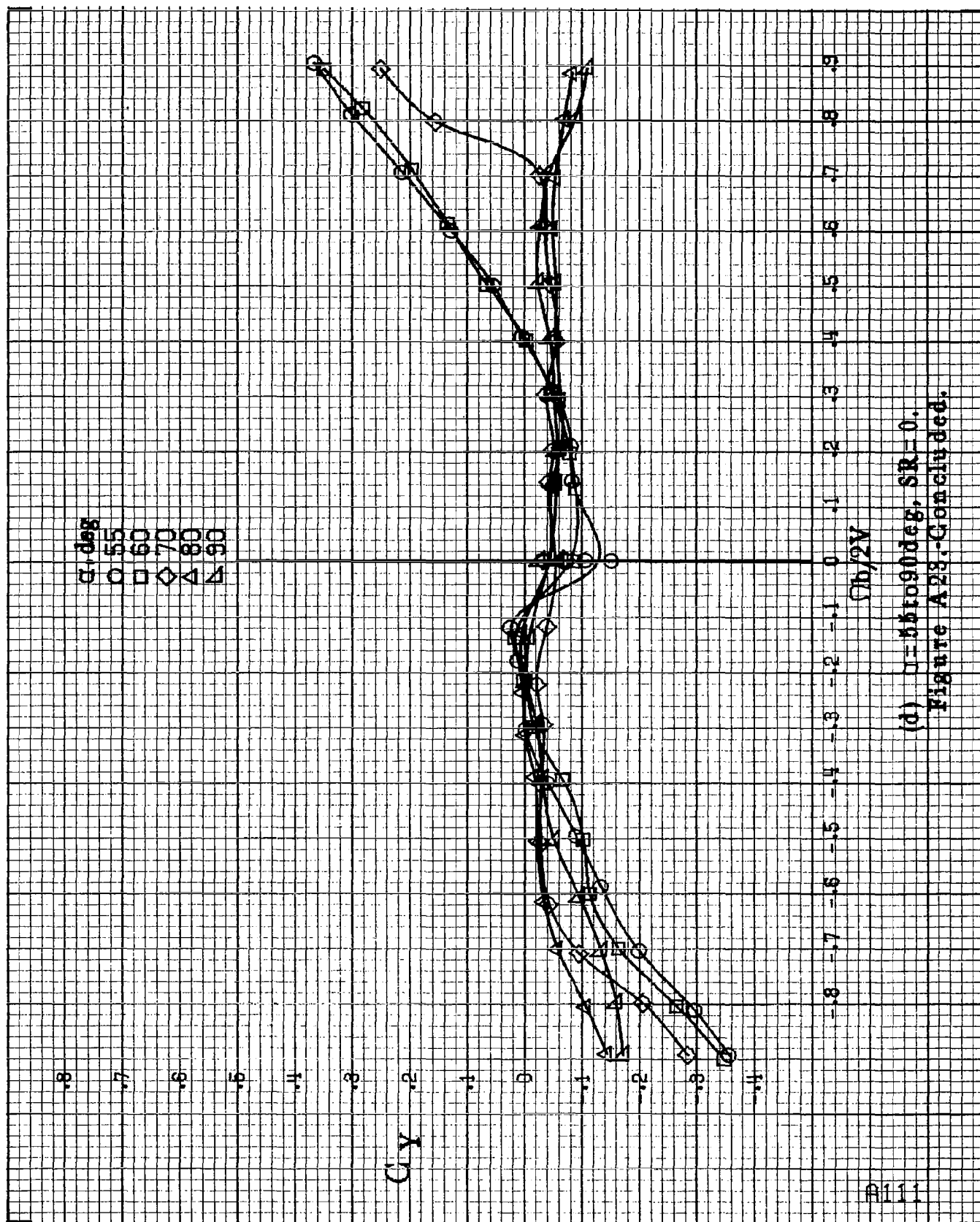
Gy

$\mu$ , deg  
 30  
 35  
 40  
 45  
 50

$\Omega b/2V$

(c)  $\sigma = 30$  to  $60$  deg,  $SR = 0$ .  
 Figure A28.-Continued.



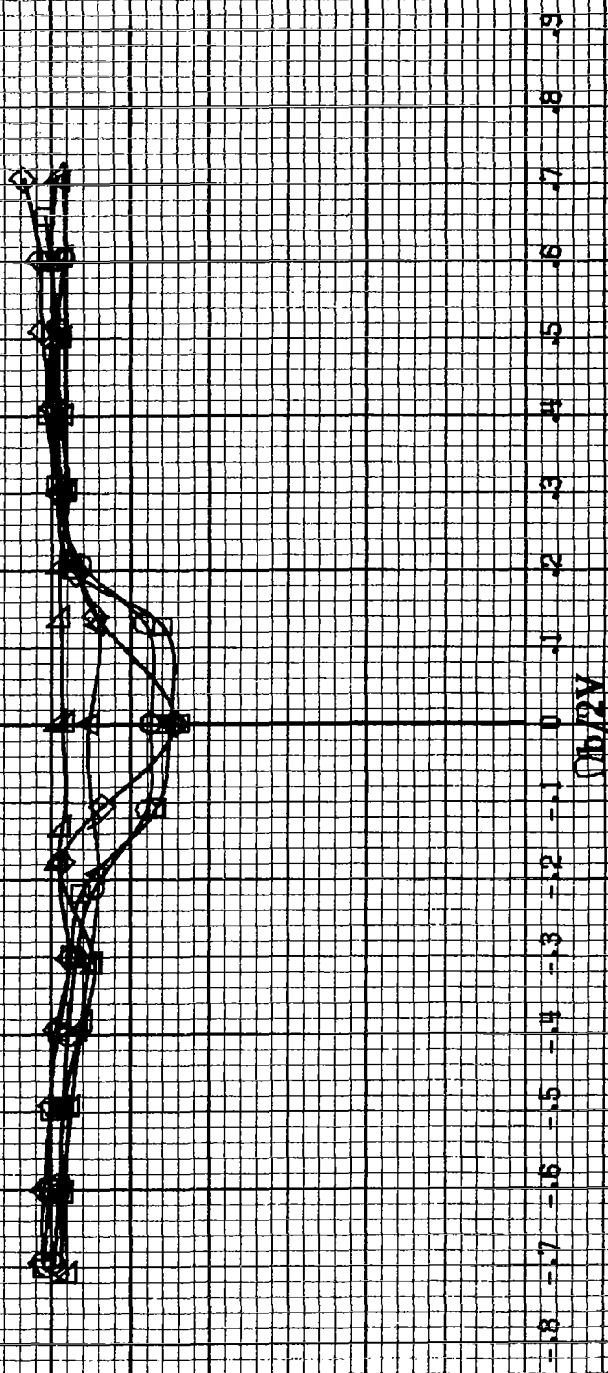


(d)  $\alpha = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A23.-Concluded.

91112

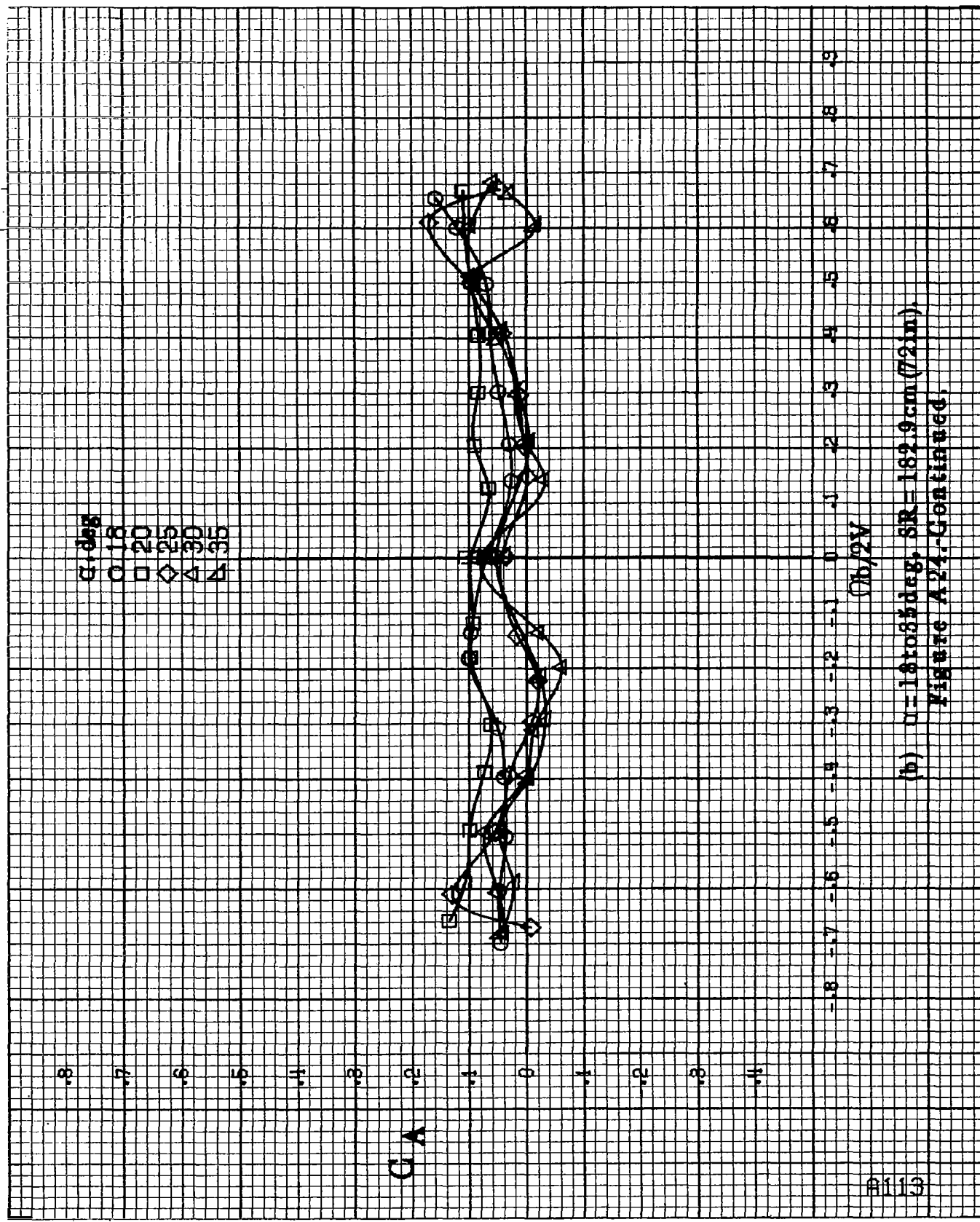
$C_A$

$\alpha, \text{deg}$   
 $\circ 8$   
 $\square 10$   
 $\diamond 12$   
 $\triangle 14$   
 $\nabla 16$



(a)  $\alpha = 8$  to  $16$  deg,  $SR = 1.92$ ,  $Re_m (72 \text{ in})$ .

Figure A24.-Effect of rotation rate and angle of attack on axial-force coefficient for basic configuration.  $\delta_a = 15^\circ$ ,  $\delta_s = 15.0^\circ$ ,  $\delta_r = 25^\circ$ ,  $\beta = 0^\circ$ .



(b)  $\mu=18$  to  $85$  deg,  $SR=162.9$  cm (72 in).  
Figure A24-Continued.

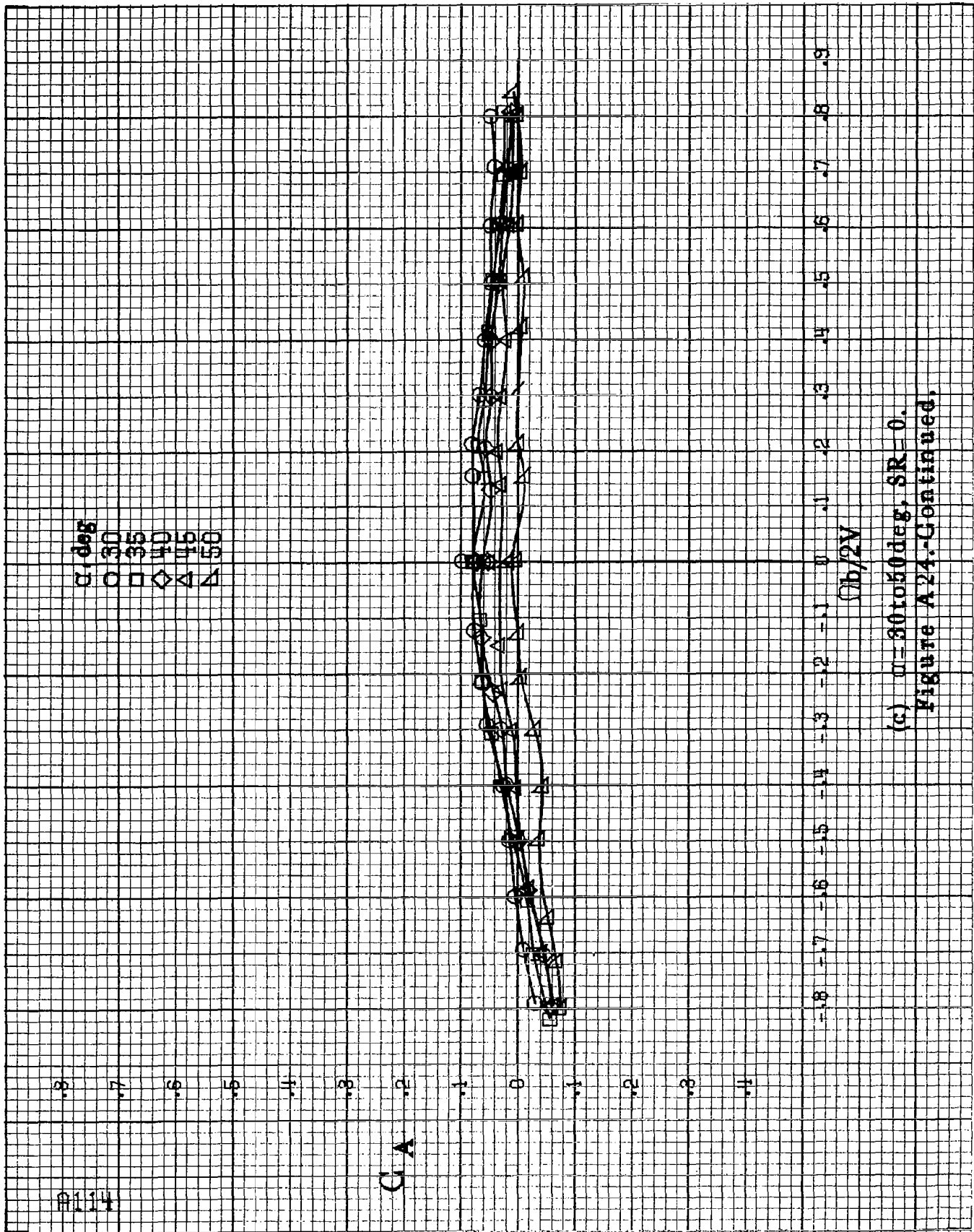
1114

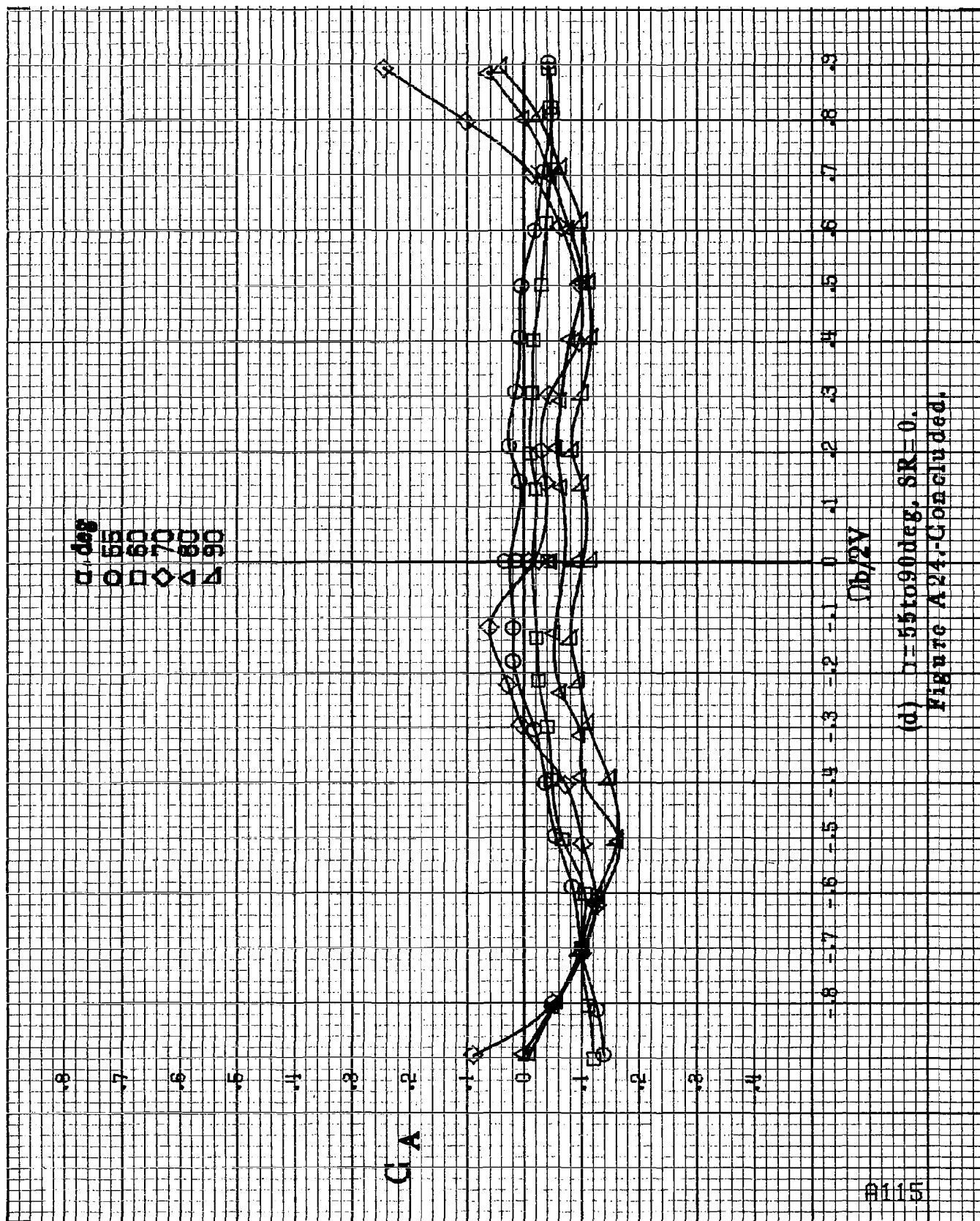
C/A

$\alpha$  deg  
 ○ 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▽ 50

$\Omega b/2V$

(c)  $\mu=30$  to  $50$  deg,  $SR=0$ .  
 Figure A24-Continued.





(d)  $\gamma=55$  to  $90$  deg,  $SR=0$ .  
Figure A24.-Concluded.

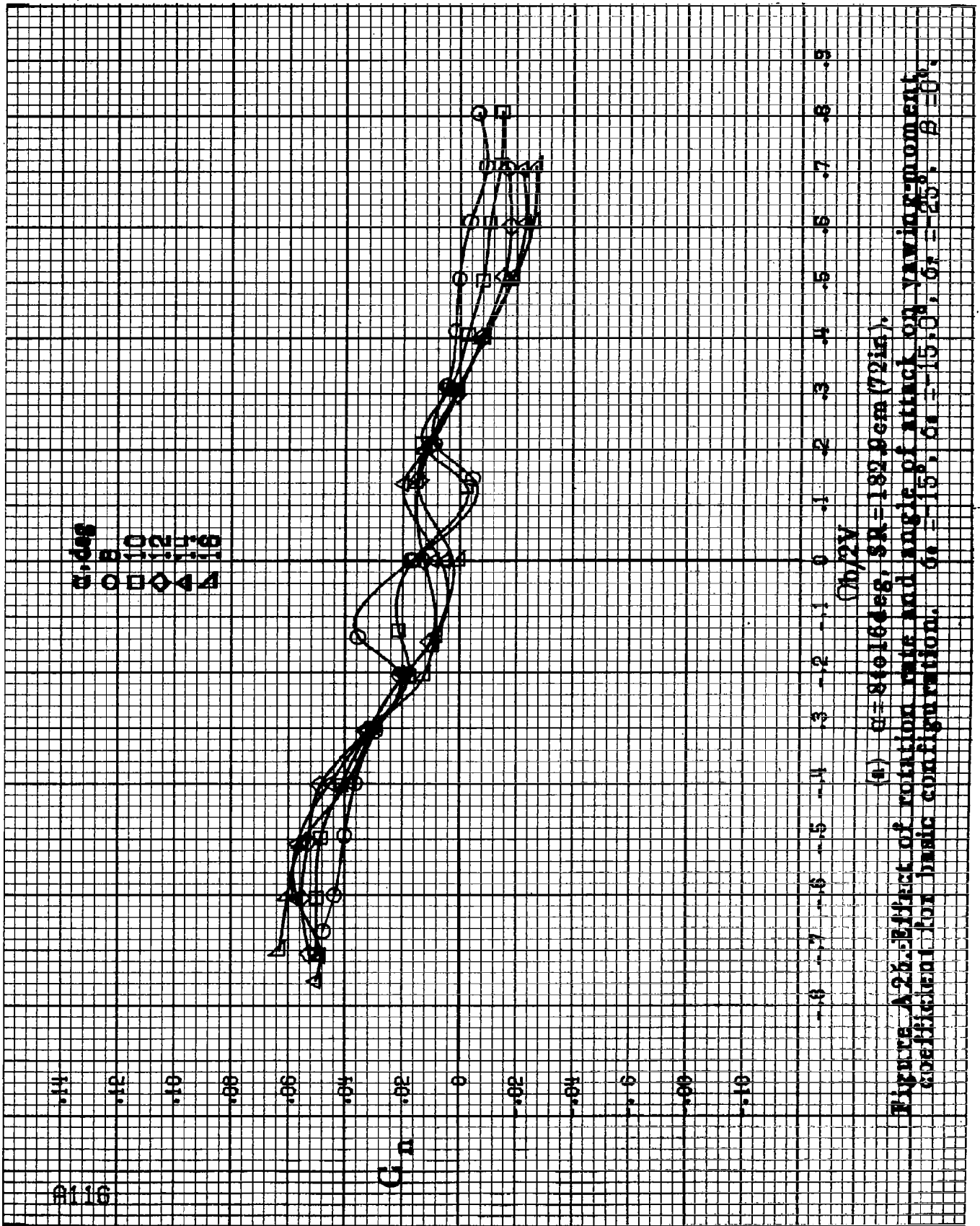
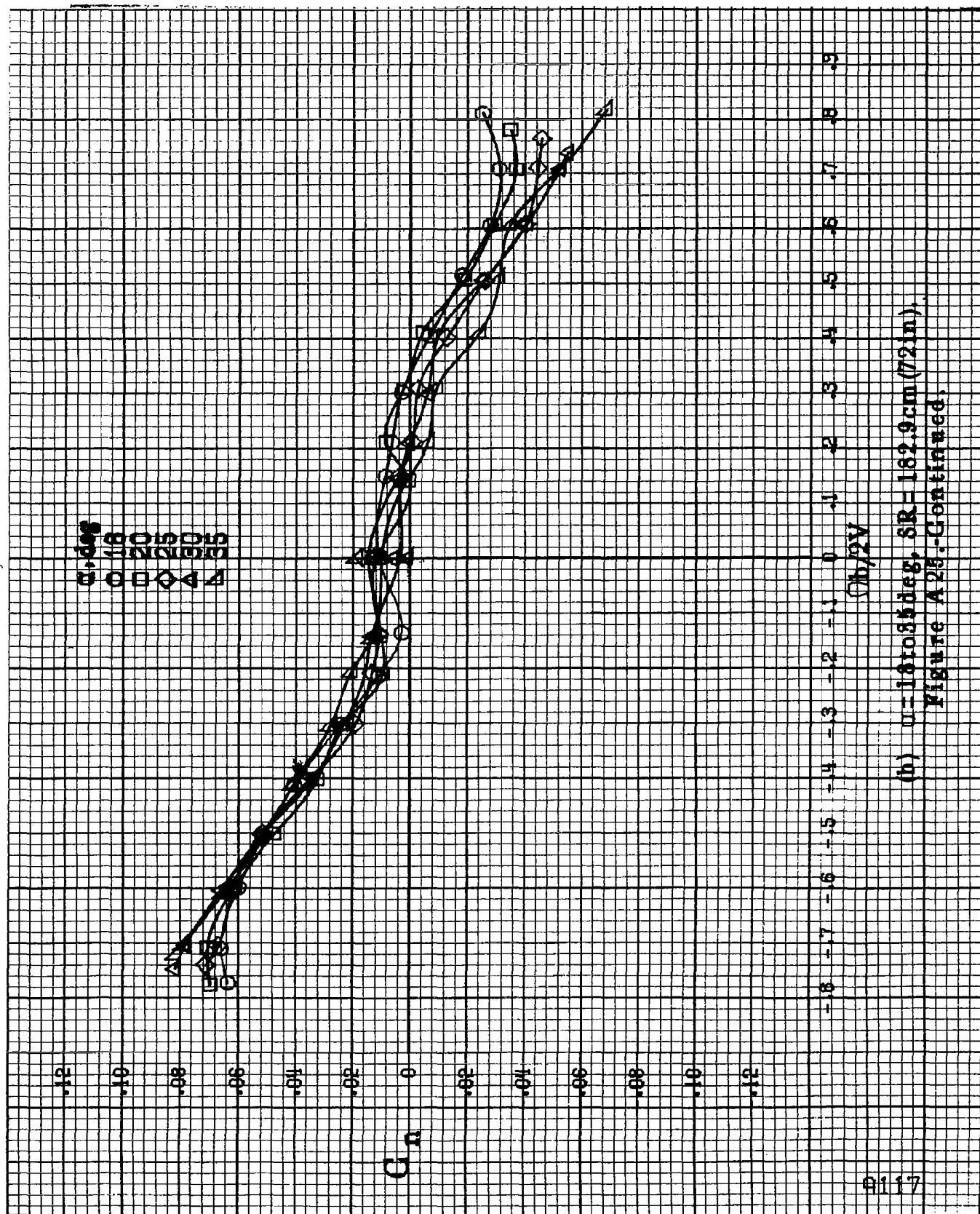


Figure A25. Effect of rotation rate and angle of attack on yawing-moment coefficient for basic configuration.  $\alpha = 15^\circ$ ,  $\delta_1 = -15.0^\circ$ ,  $\delta_2 = -25^\circ$ ,  $\beta = 0^\circ$ .





(b)  $u=181085\text{deg}$ ,  $SR=162.9\text{cm (72in)}$ .

Figure A28-Continued.

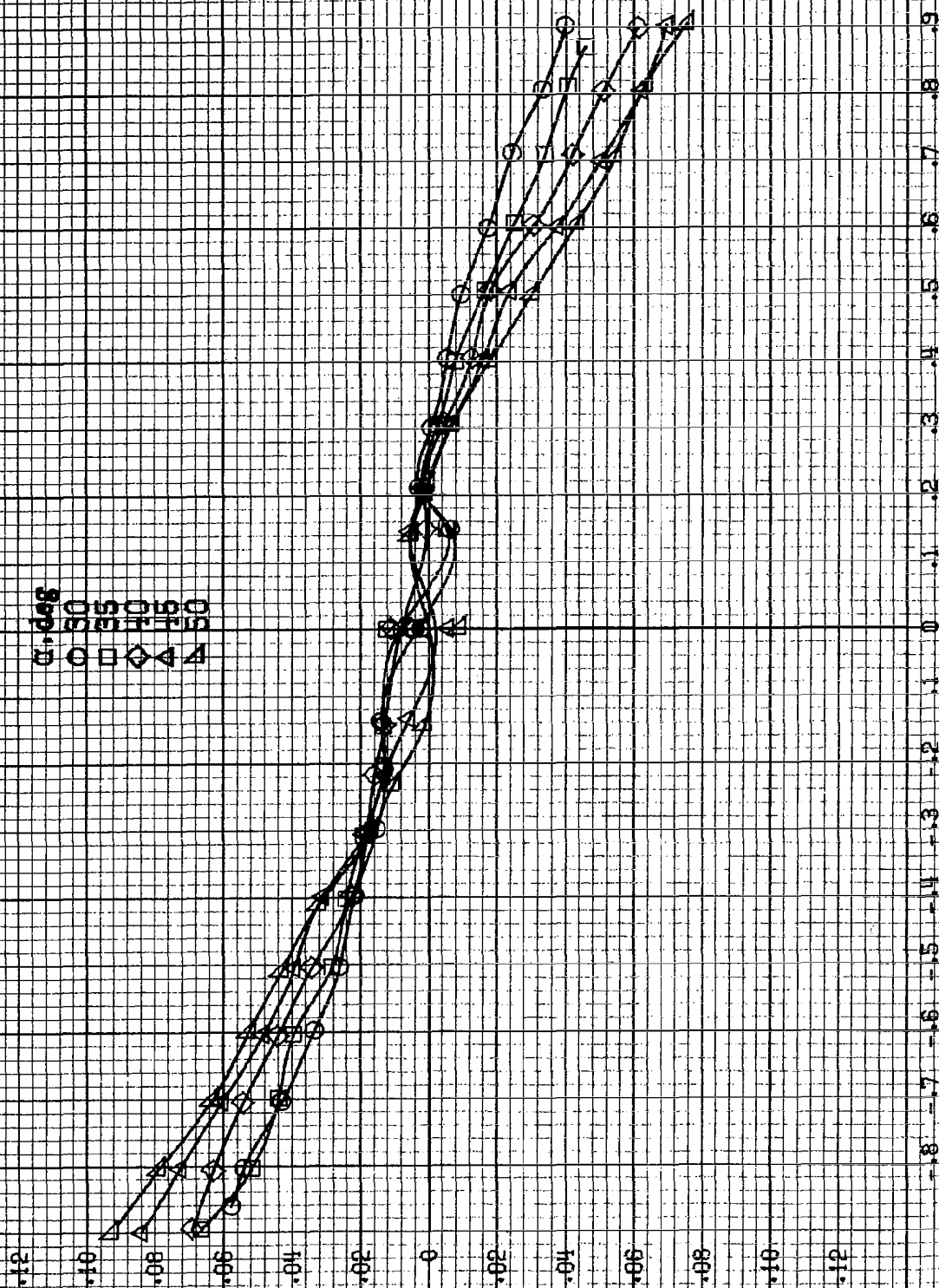
#118

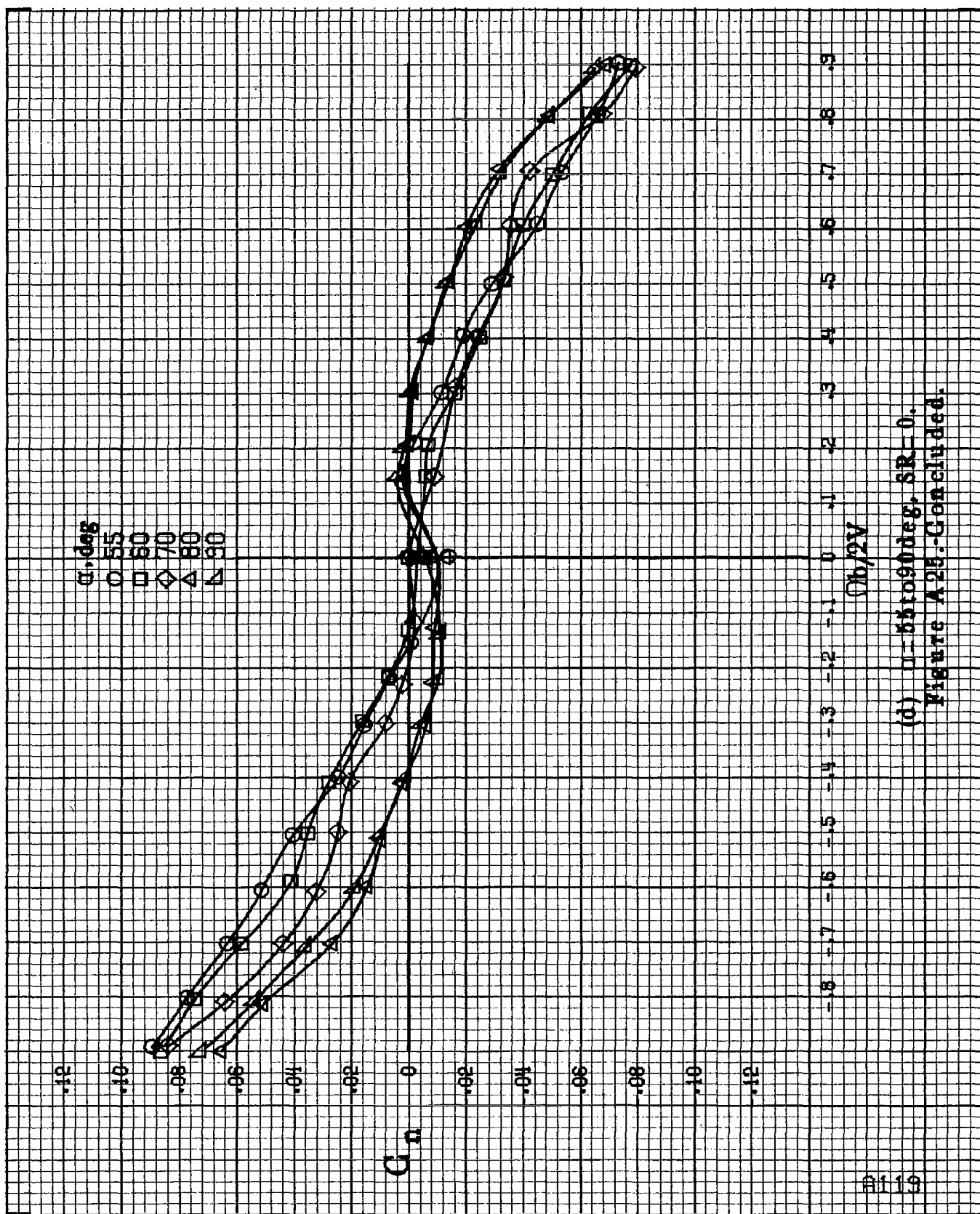
$\alpha$ , deg  
 60  
 55  
 50  
 45  
 40

$C_{Dn}$

$h/2V$

(c)  $\alpha = 30$  to  $50$  deg,  $SR = 0$ .  
 Figure A28.-Continued.





(d)  $\theta = 55$  to  $90$  deg,  $SR = 0$ .

Figure A25.-Concluded.

A120

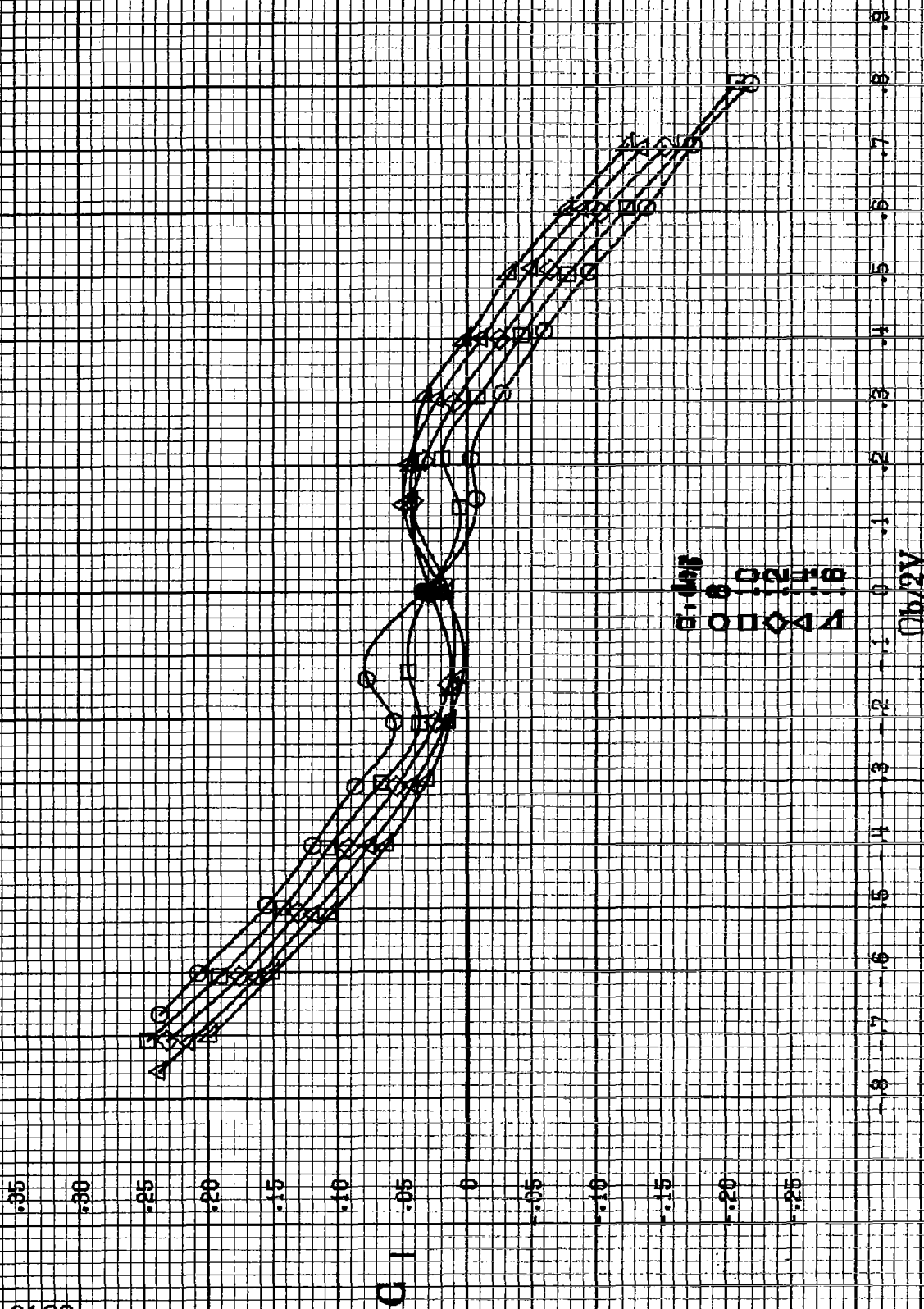
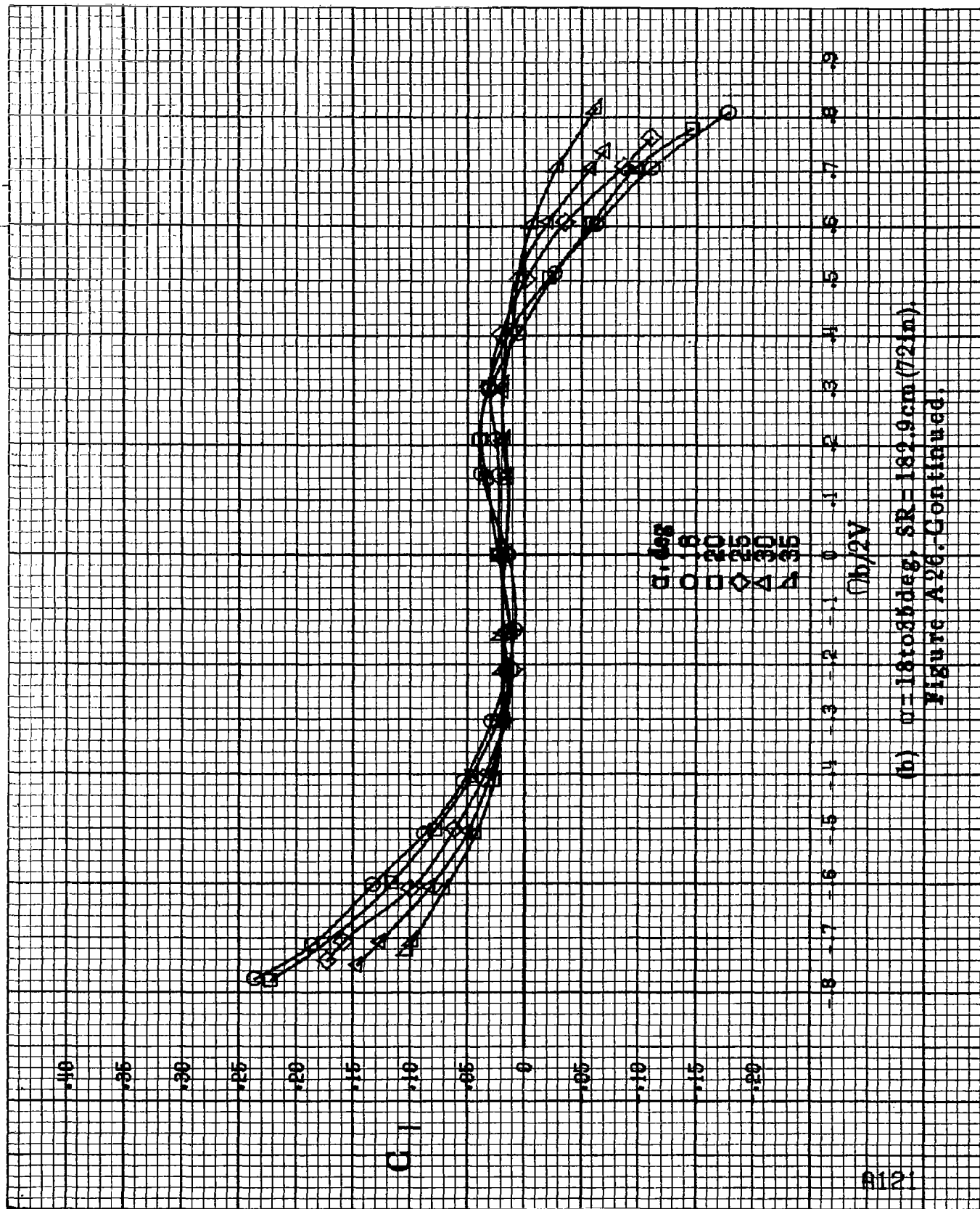
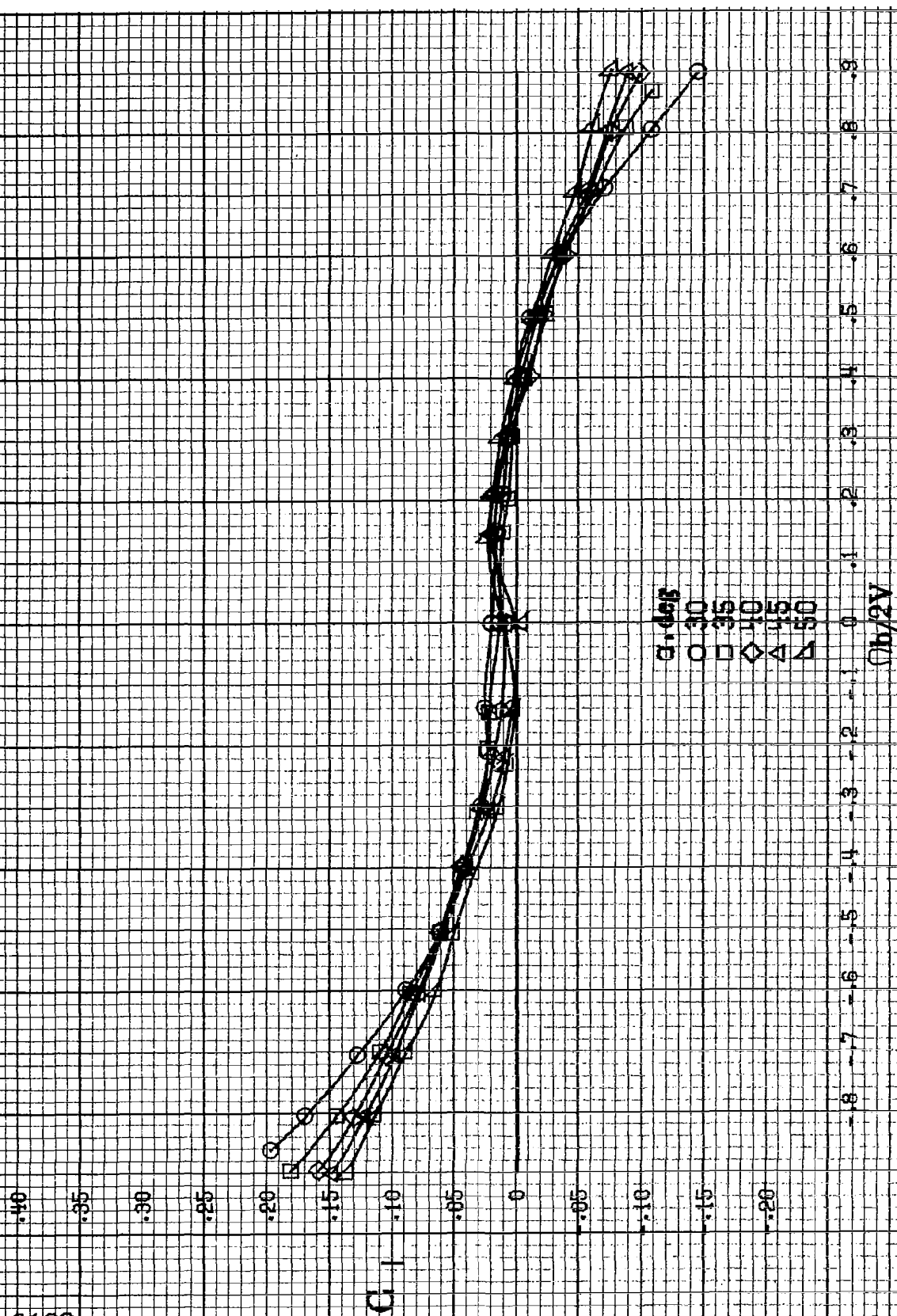


Figure A28. Effect of rotation rate and angle of attack on rolling-moment coefficient for basic configuration.  $\alpha = 8.16^\circ$ ,  $SR = 182.9 \text{ cm} (72 \text{ in})$ .  $\delta = 15^\circ$ ,  $\delta = 15.0^\circ$ ,  $\delta = 25^\circ$ ,  $\delta = 0^\circ$ .

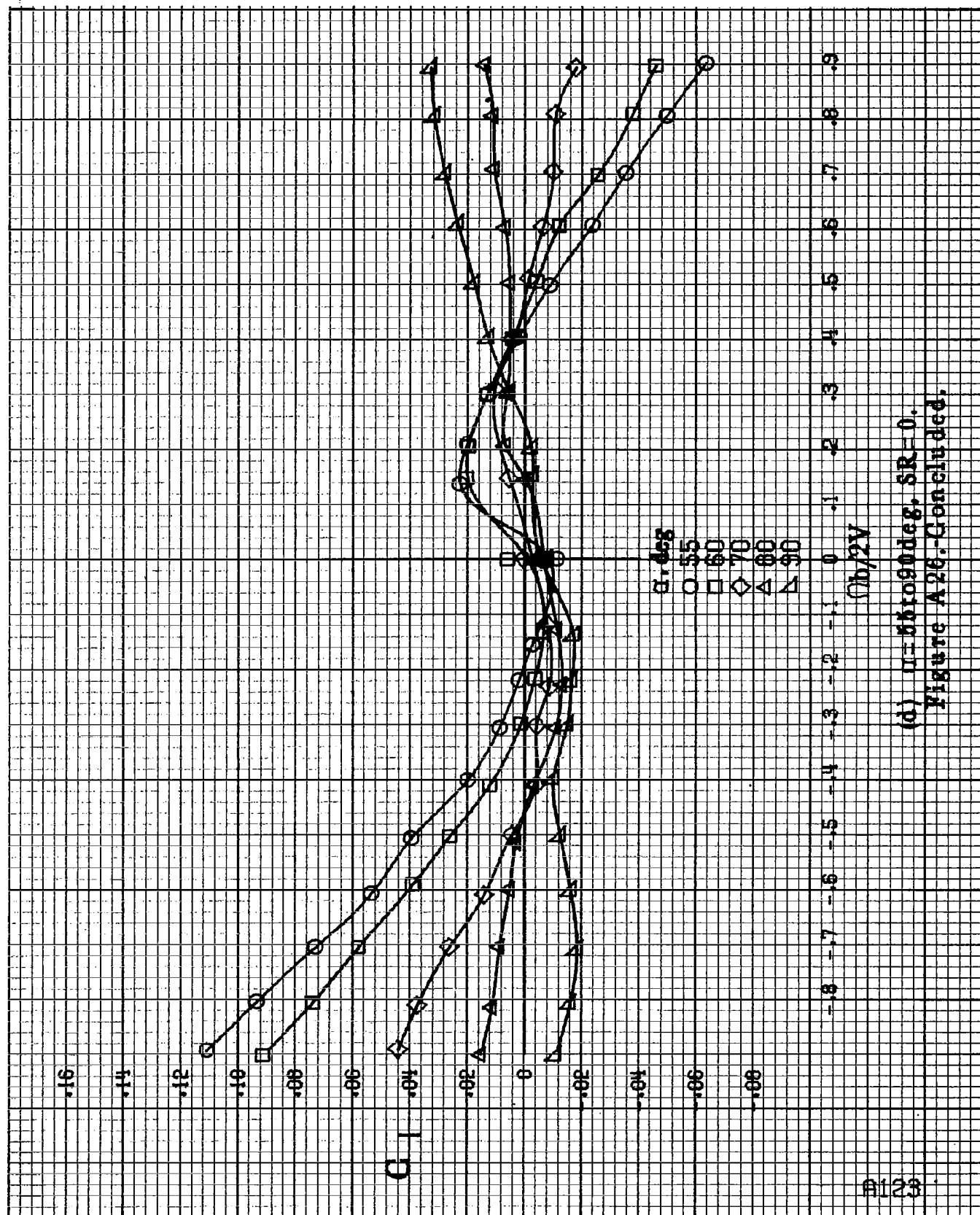


(b)  $\alpha = 18$  to  $35$  deg,  $SR = 182.9$  cm (72 in).  
Figure A26.-Continued.

A122



(c)  $\alpha=30$  to  $50^\circ$ ,  $SR=0$ .  
Figure A26.-Continued



(d)  $\alpha = 55$  to  $90^\circ$  deg,  $\delta R = 0$ .  
Figure A26.-Concluded.

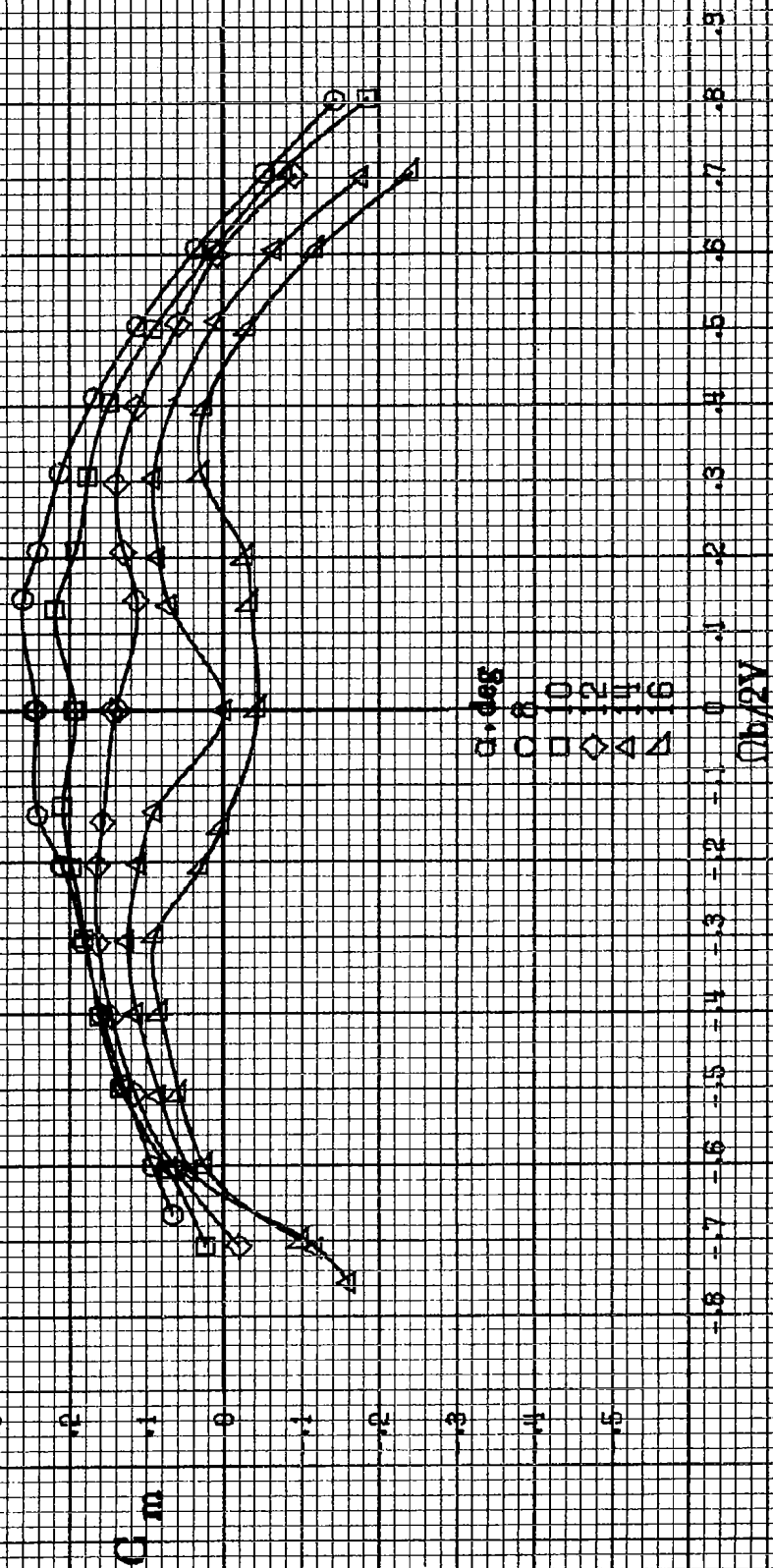
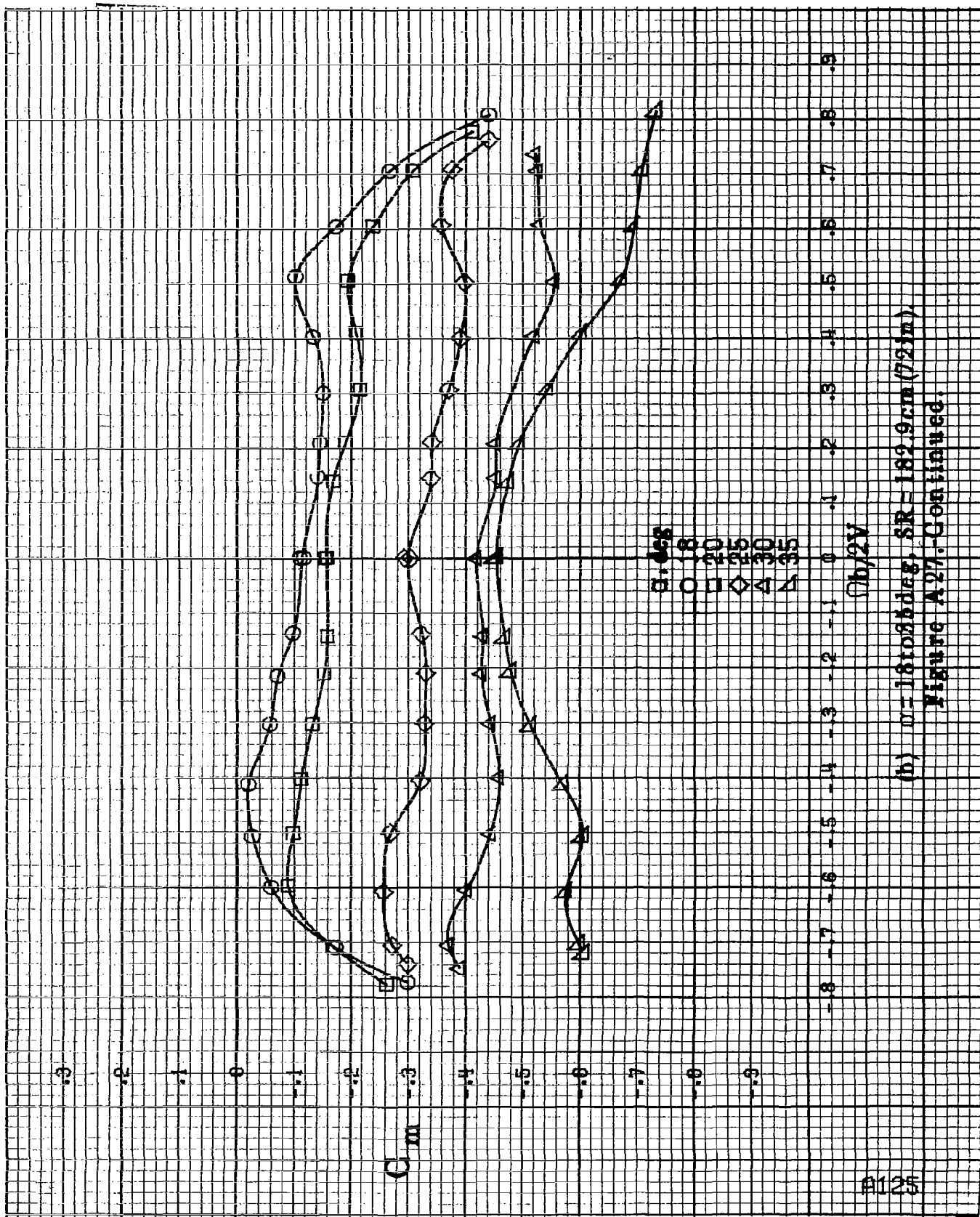


Figure A27. Effect of rotation rate and angle of attack on pitching moment coefficient for basic configuration.  $\delta_a = -15^\circ$ ,  $\delta_r = 15.0^\circ$ ,  $\delta_r = 25^\circ$ ,  $\beta = 0^\circ$ .





(b)  $m = 18108 \text{ deg}$ ,  $SR = 182.9 \text{ cm (72 in)}$

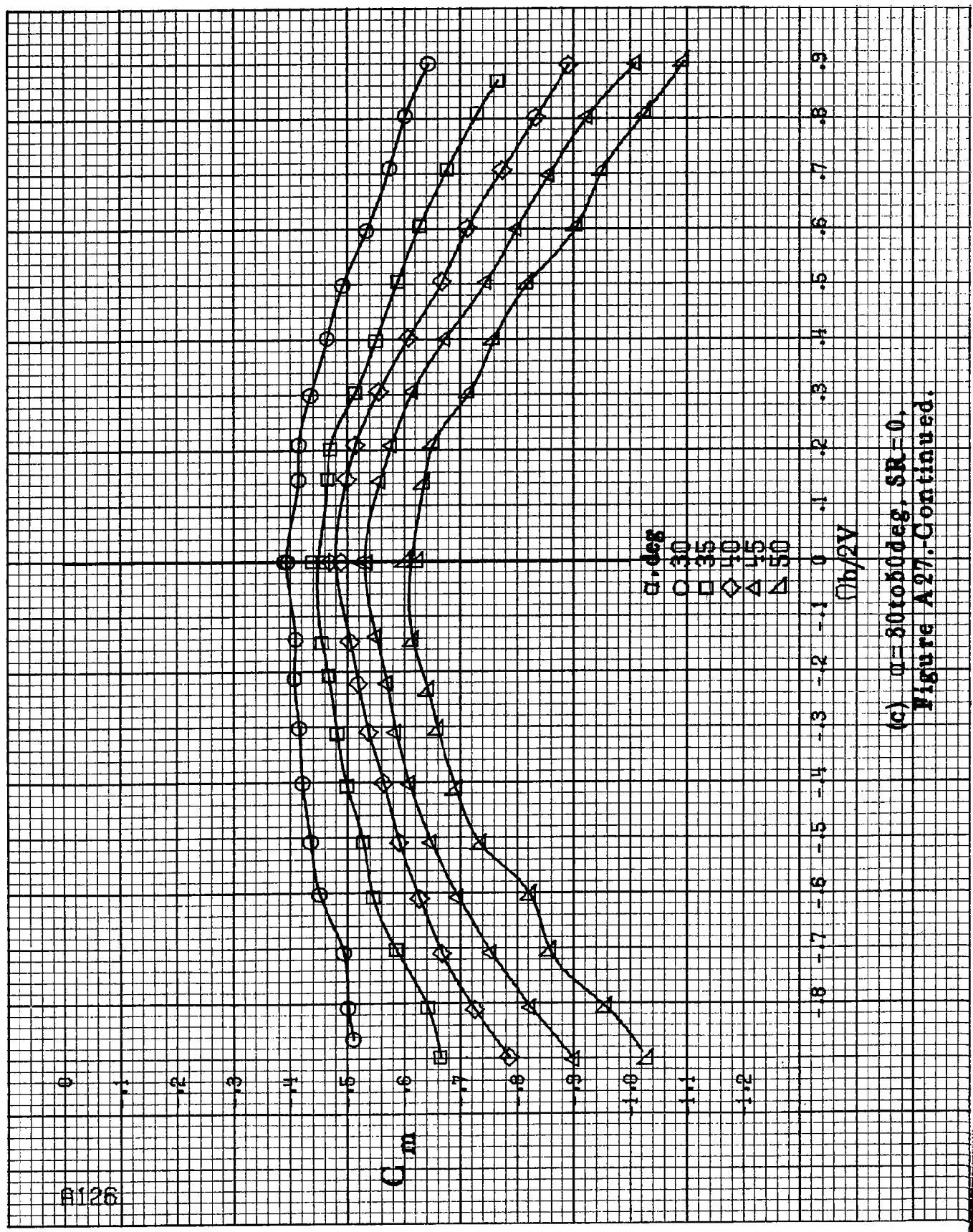
Figure A27.-Continued.

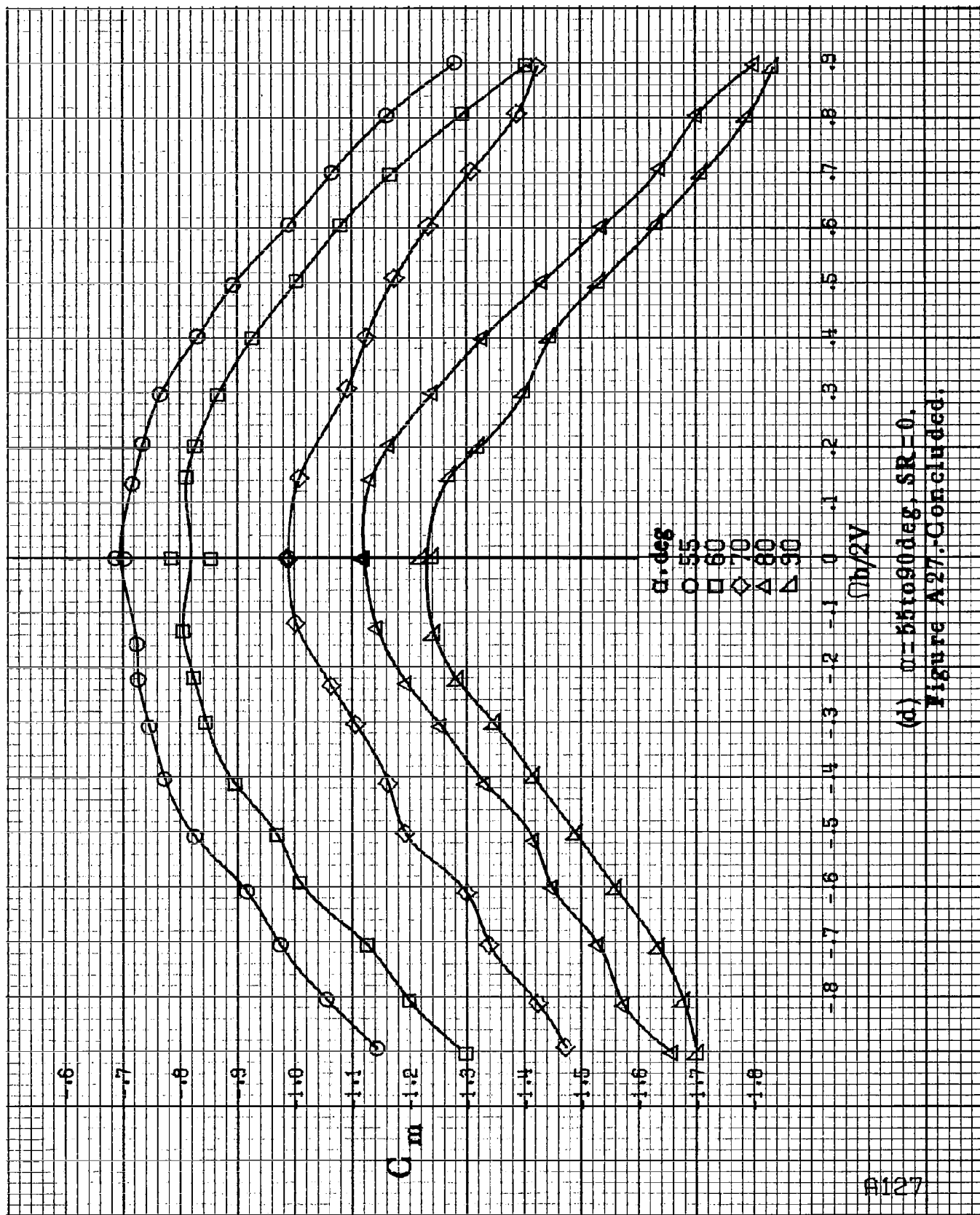
$G_m$

$\alpha, \text{deg}$   
 $\circ 30$   
 $\square 35$   
 $\diamond 40$   
 $\triangle 45$   
 $\nabla 50$

$\phi_b/2V$

(c)  $\phi = 80$  to  $50$  deg,  $SR = 0$ .  
 Figure A 27.-Continued.



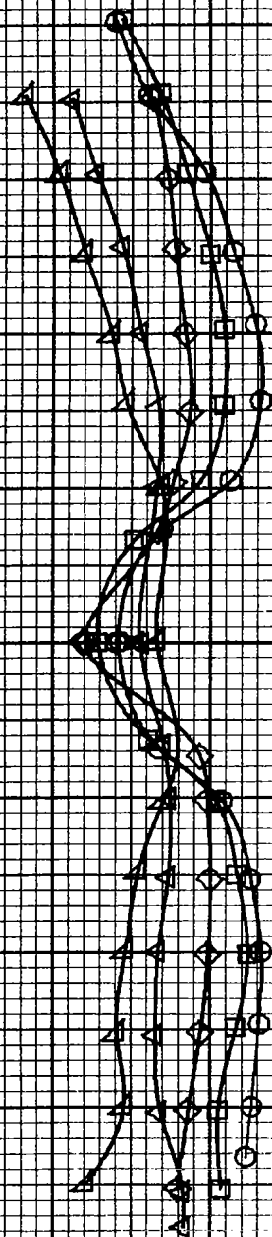


(d)  $\alpha = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A27: Concluded.

A128

$\alpha, \text{deg}$   
 $\circ$  8  
 $\square$  10  
 $\diamond$  12  
 $\triangle$  14  
 $\nabla$  16

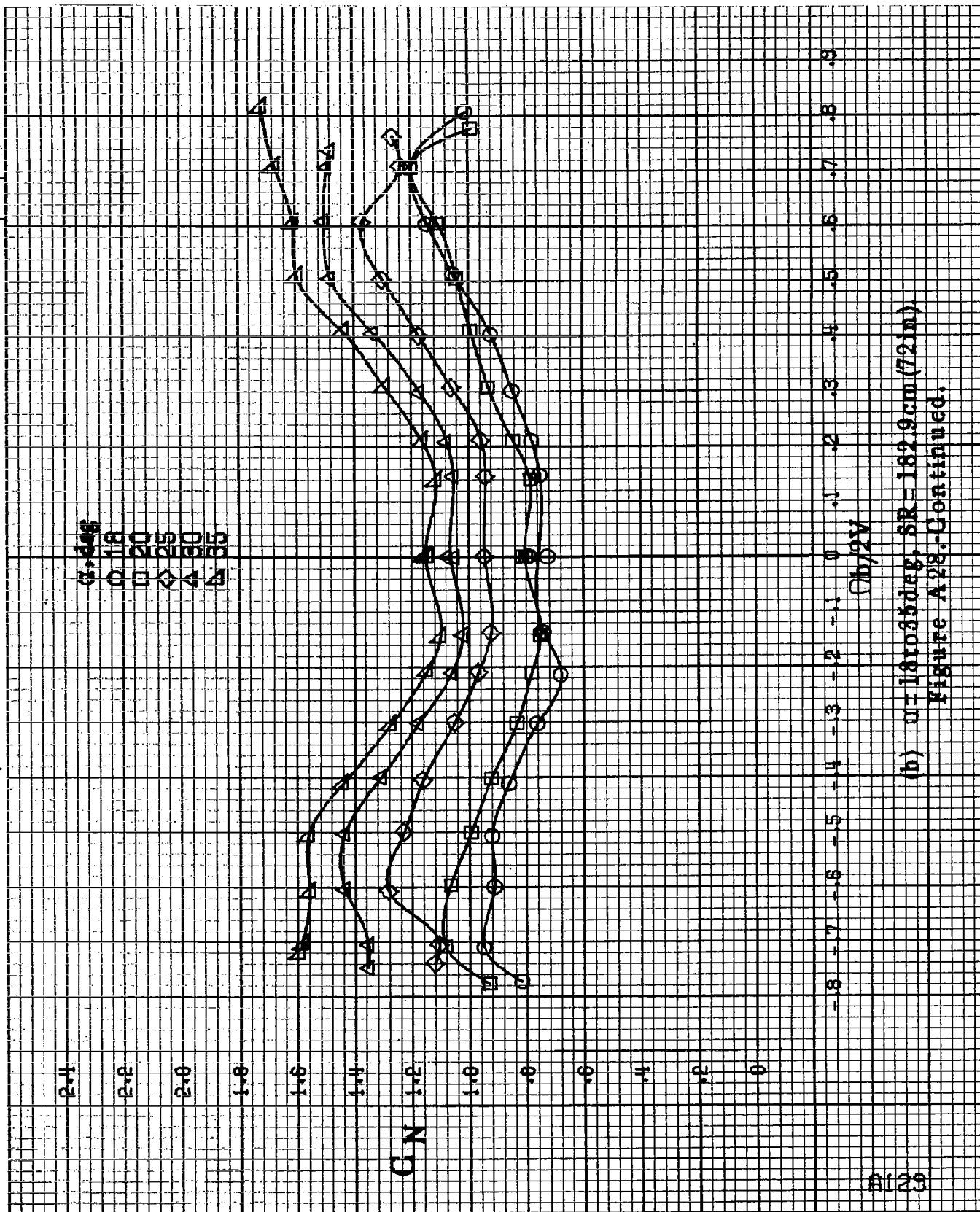
CN



Ob/2V

(a)  $\alpha = 8$  to  $16$  deg, SR = 182.9 cm (72 in).

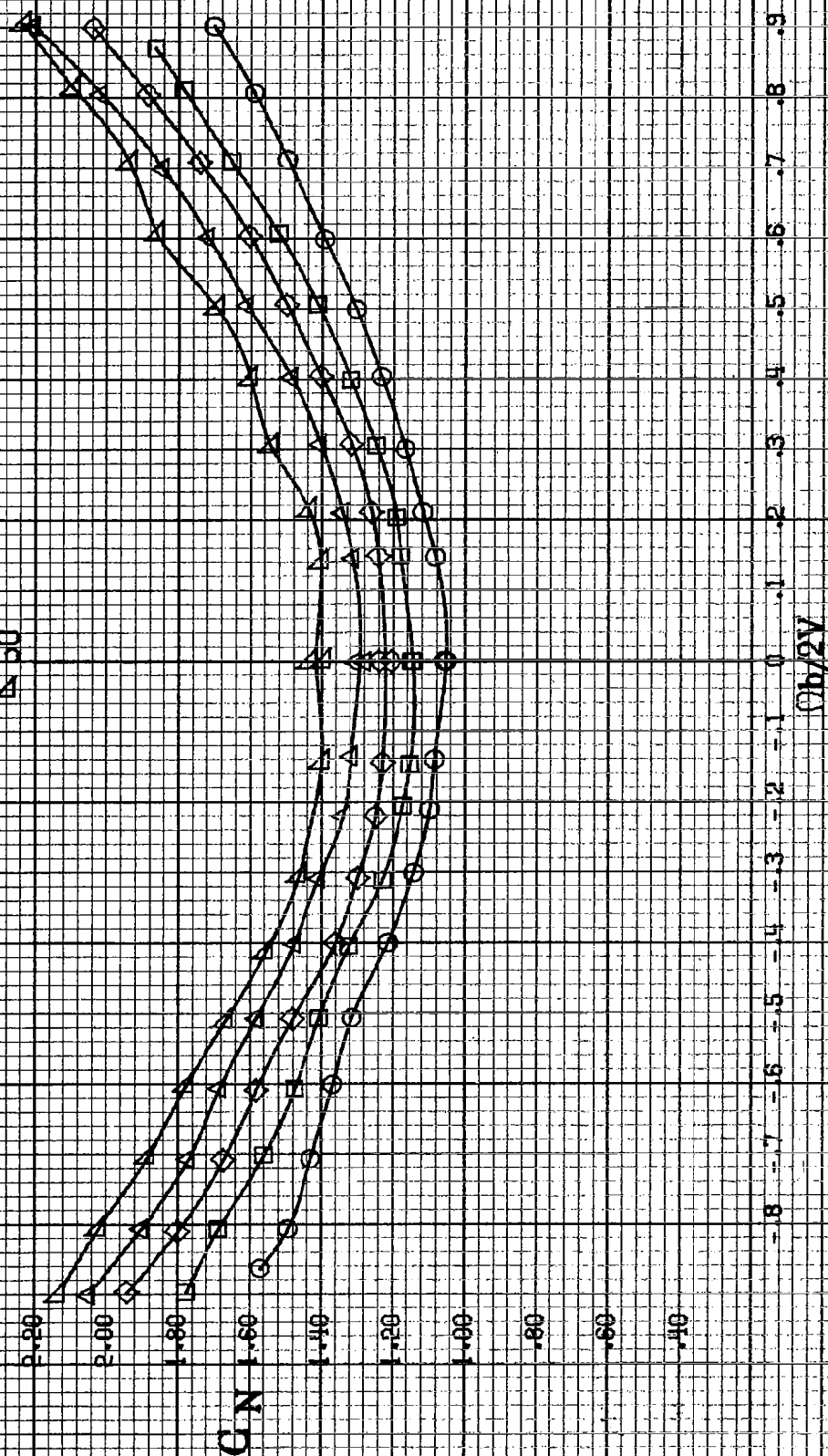
Figure A28. Effect of rotation rate and angle of attack on normal force coefficient for basic configuration.  $\delta_a = 15^\circ$ ,  $\delta_n = 15.0^\circ$ ,  $\delta_r = 0^\circ$ .



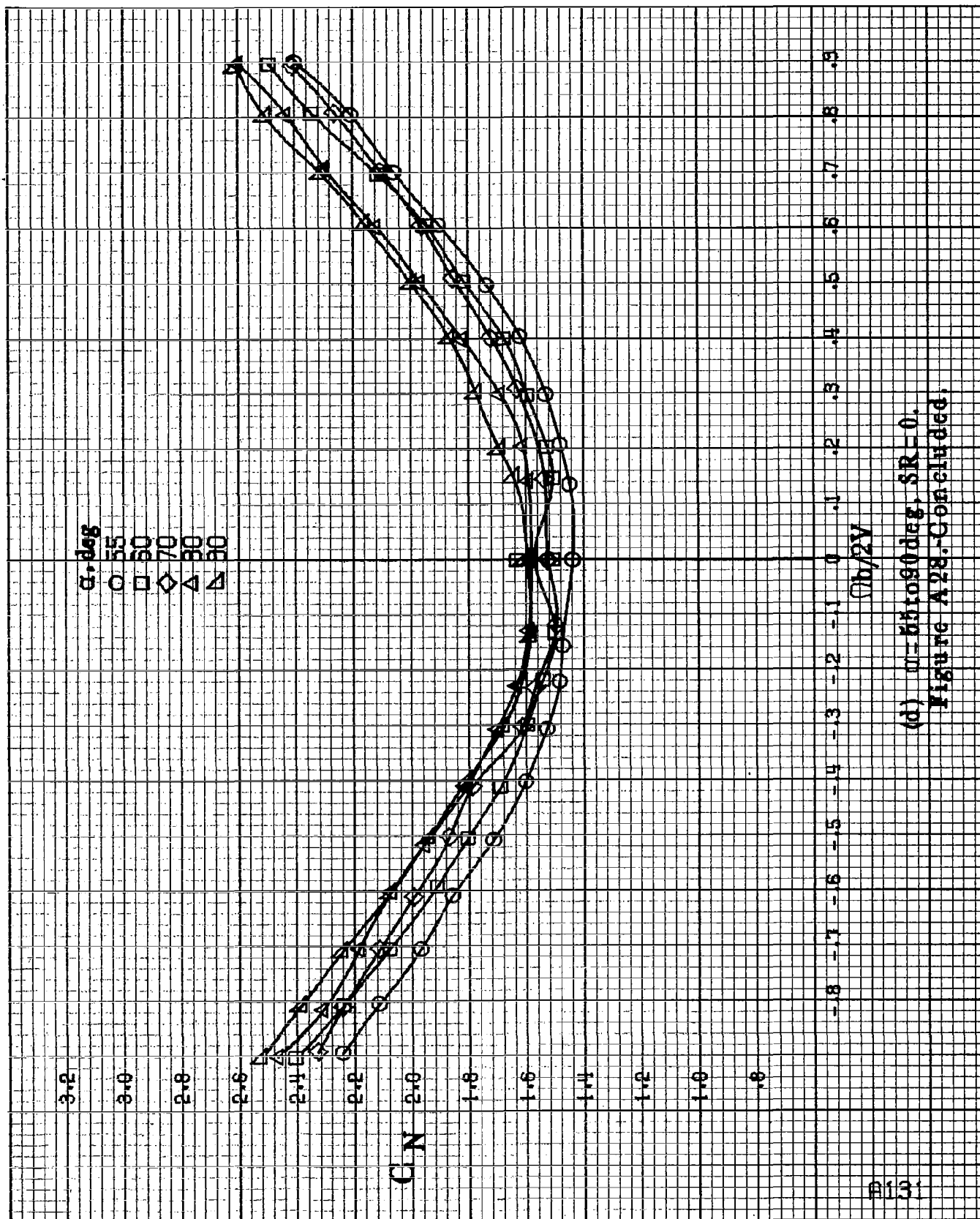
(h)  $\mu=18.055 \text{ deg}$ ,  $SR=182.9 \text{ cm}(72 \text{ in})$ .  
Figure A28-Continued.

A130

$\mu, \text{deg}$   
 30  
 25  
 20  
 15  
 10



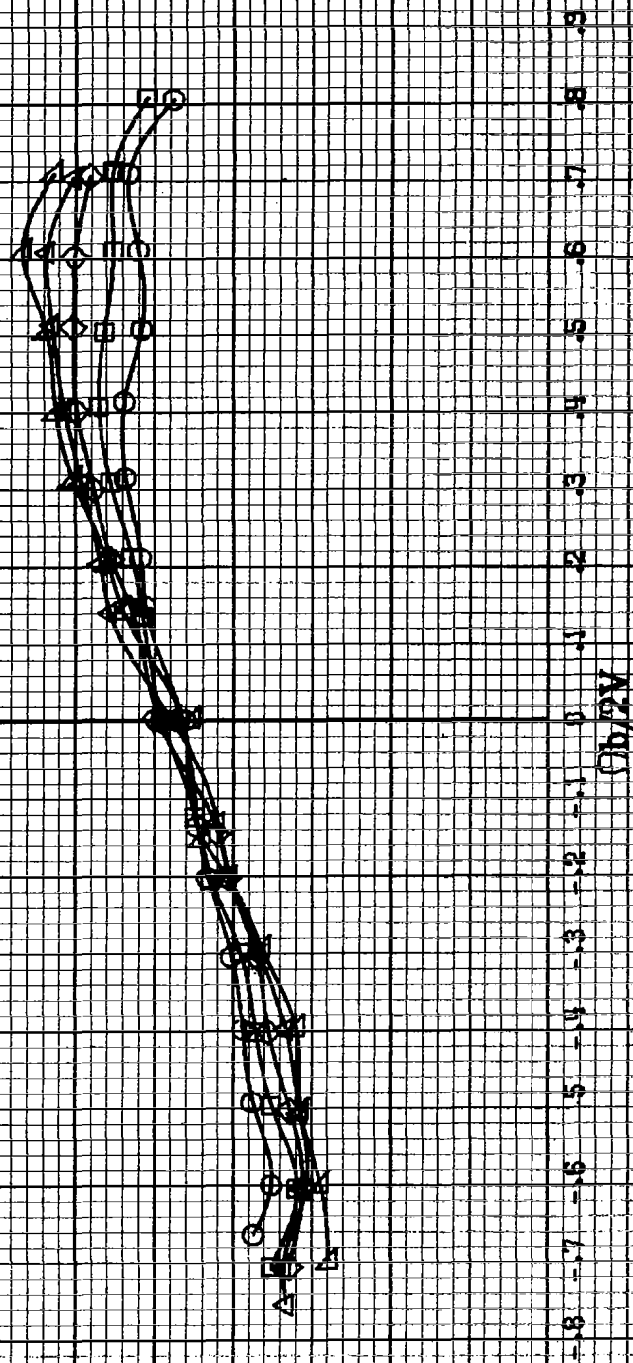
(a)  $\mu=30$  to  $50$  deg,  $SR=0$ ,  
 Figure A28.-Continued.



(d)  $m=55$  to  $90^\circ$ ,  $SR=0$ .  
Figure A28-Continued.

$\alpha$  deg  
 $\square$  0  
 $\square$  6  
 $\square$  12  
 $\square$  18  
 $\square$  24  
 $\square$  30

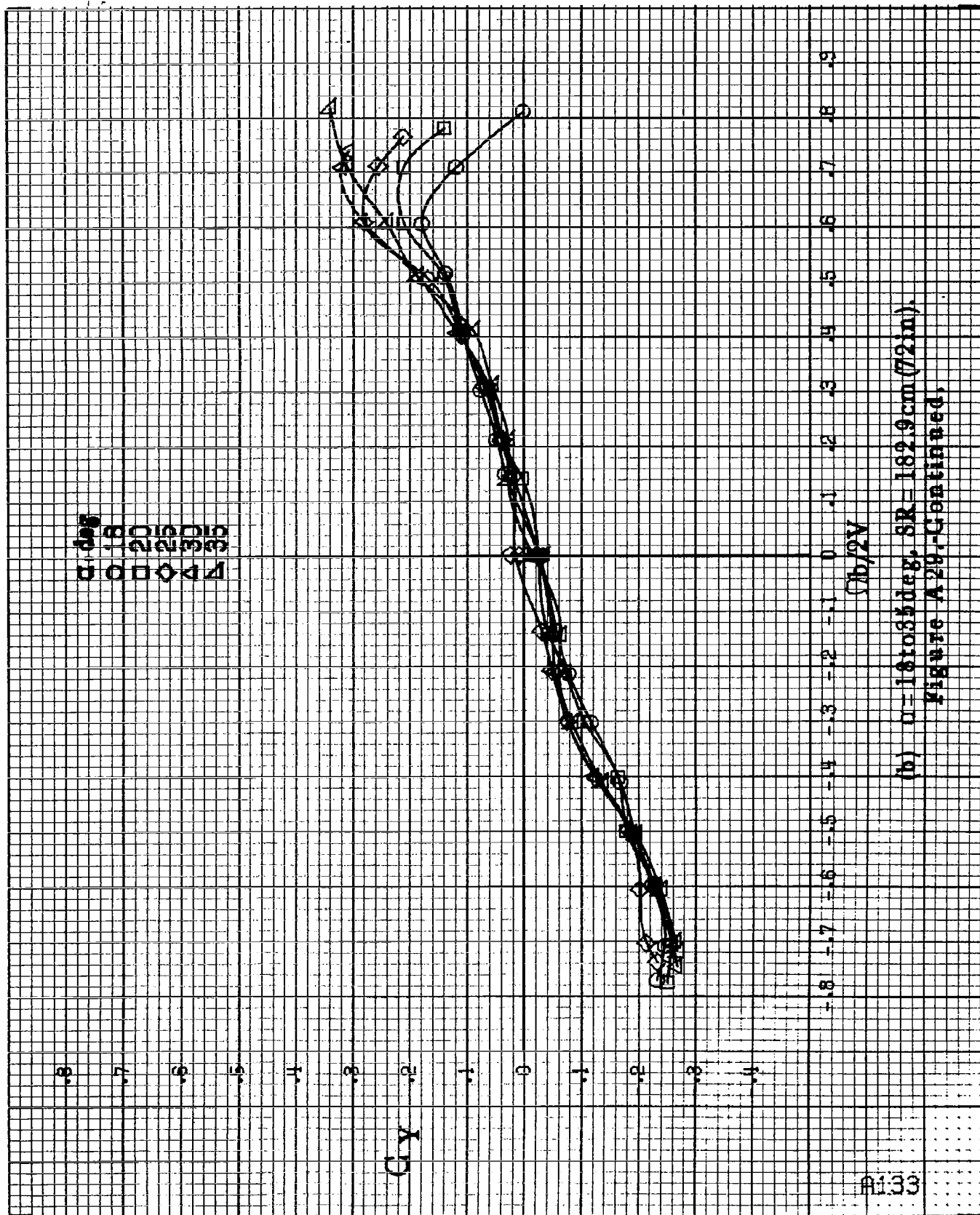
$C_Y$



(a)  $G = 8$  to 16 deg,  $SR = 182.9 \text{ cm} (72 \text{ in})$ .

Figure A28. Effect of rotation rate and angle of attack on side-force coefficient for basic configuration.  $\alpha = 15^\circ$ ,  $\alpha = 15.5^\circ$ ,  $\alpha = 25.5^\circ$ ,  $\alpha = 0^\circ$ .





(b)  $\alpha = 18$  to  $33$  deg,  $SR = 182.9$  cm (72 in).  
Figure A29.-Continued.

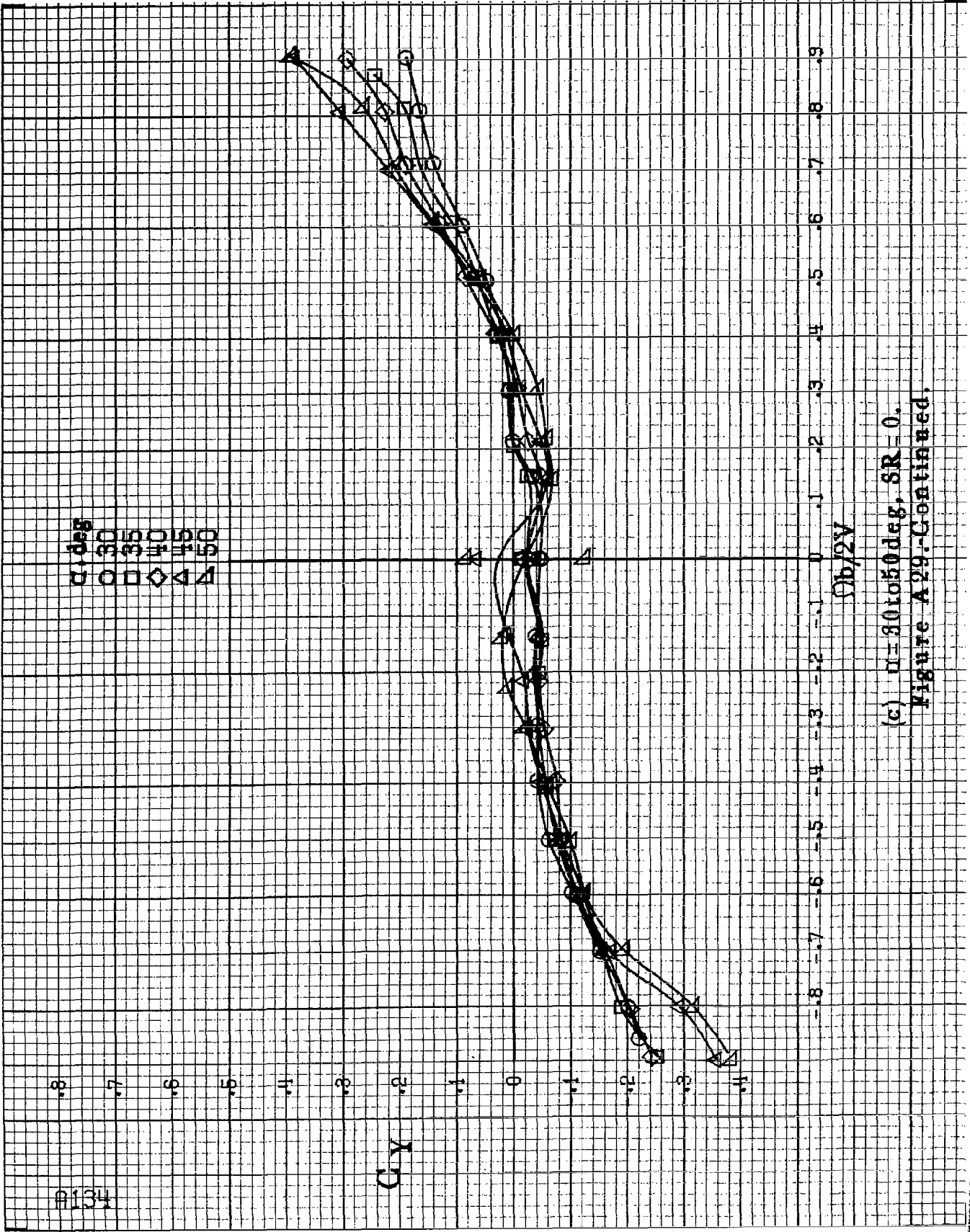
#134

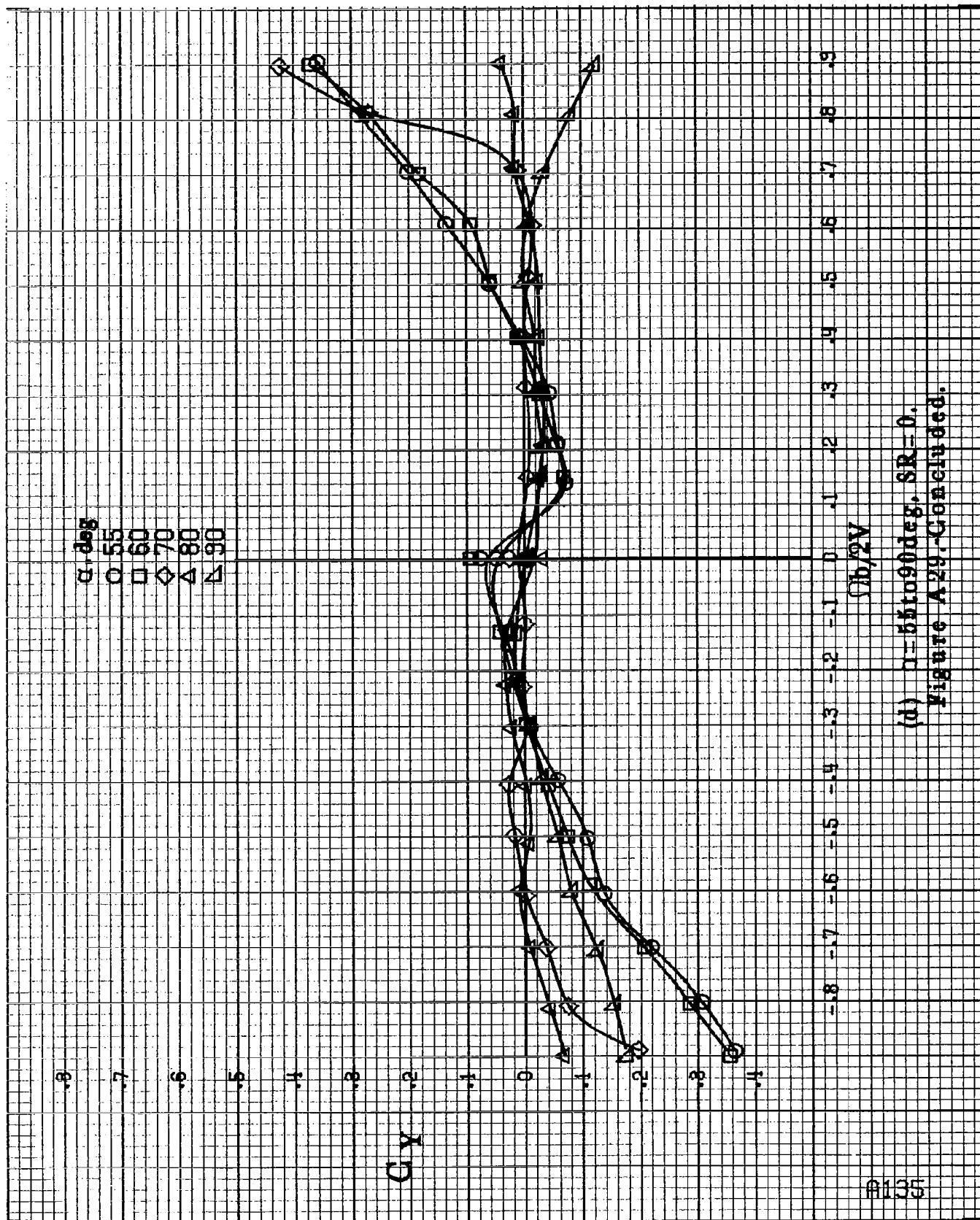
$\alpha$ , deg  
 ○ 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▲ 50

CY

$\Omega b/2V$

(c)  $n=30$  to  $50$  deg,  $SR=0$ .  
 Figure A29.-Continued.



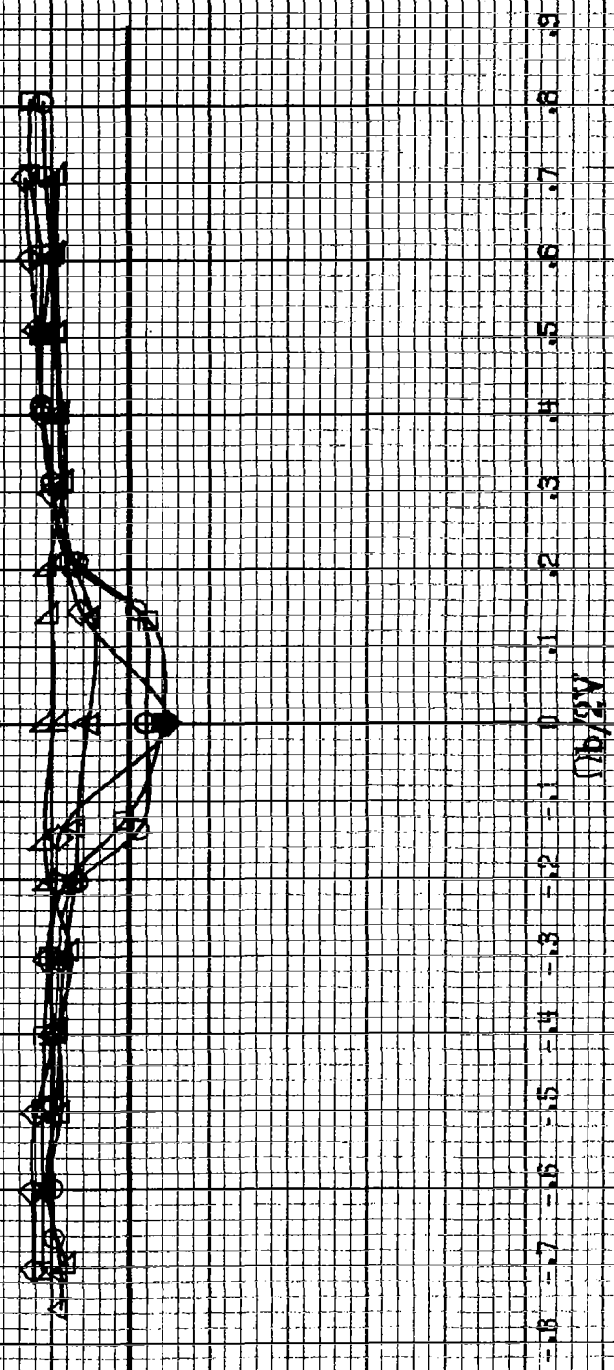


(d)  $\alpha = 55$  to  $90^\circ$  deg. SR = 0.  
Figure A29. Concluded.

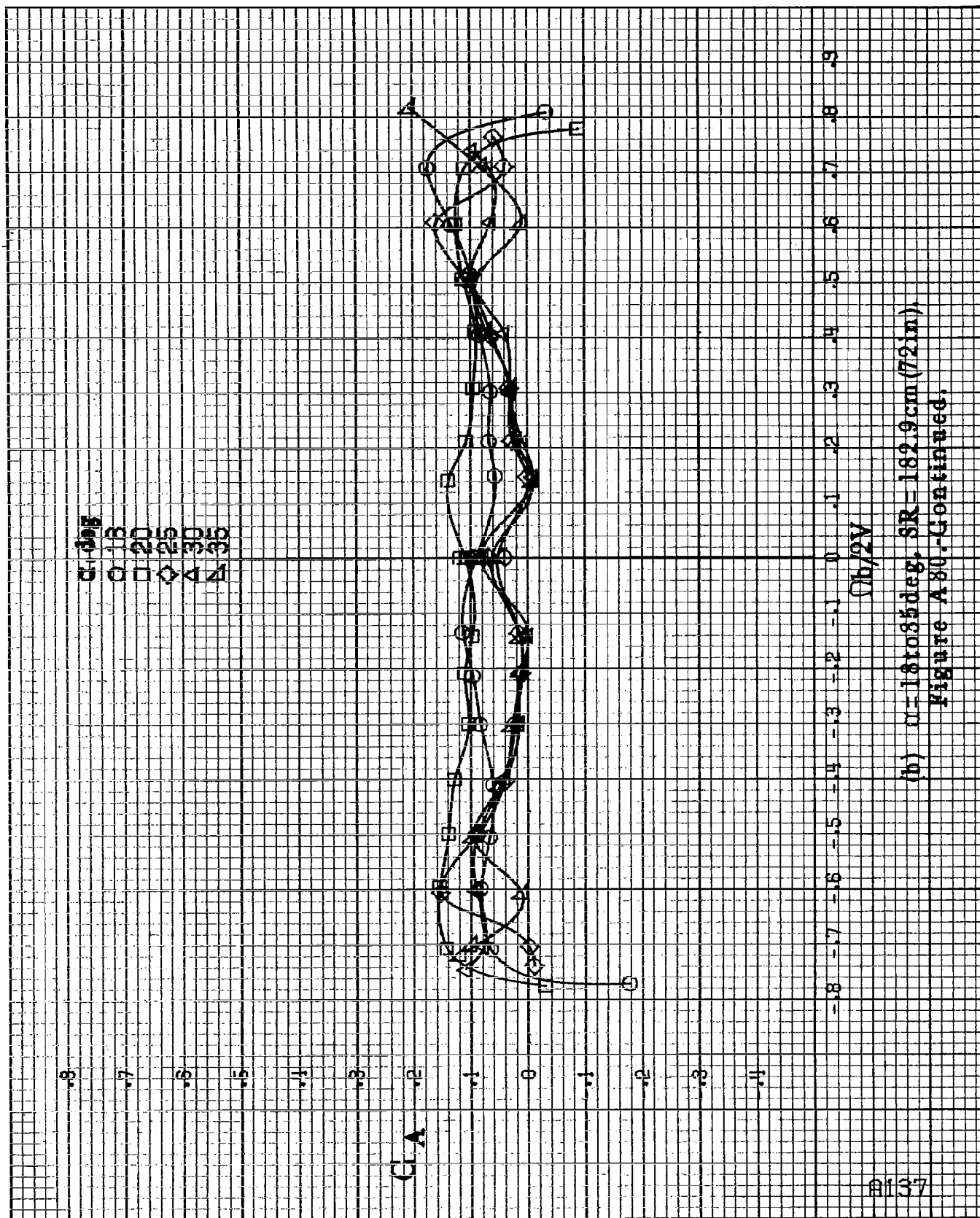
1136

$\alpha$ , deg  
 O 8  
 □ 10  
 ◇ 12  
 △ 14  
 ▽ 16

C.A.



(a)  $\alpha = 8^\circ$  to  $16^\circ$ ,  $SR = 132.9$  cm (72 in.).  
 Figure A30. Effect of rotation rate and angle of attack on axial-force coefficient for basic configuration.  $\phi_s = -15^\circ$ ,  $\phi_r = -15.0^\circ$ ,  $\phi_r = -25^\circ$ ,  $\beta = 0^\circ$ .

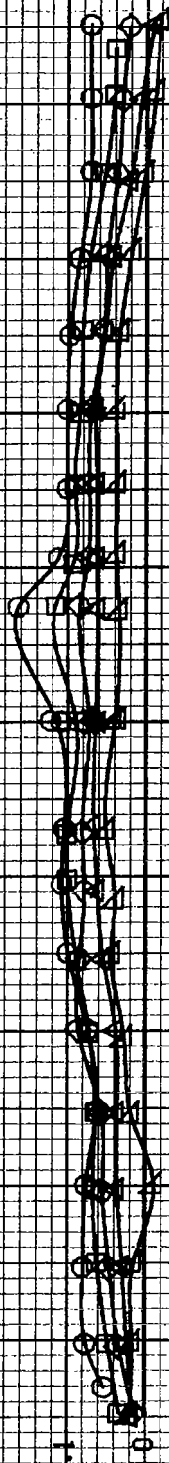


(b)  $\alpha = 18$  to  $35$  deg,  $SR = 182.9$  cm (72 in).  
 Figure A 80.-Continued.

$\alpha$ , deg

○ 30  
□ 35  
◇ 40  
△ 45  
▽ 50

$C_A$



$b/2V$

(a)  $\alpha = 30$  to  $50$  deg,  $SR = 0$ .  
Figure A80-Continued.

$\alpha$ , deg  
 □ 55  
 □ 60  
 ◇ 70  
 △ 80  
 ▽ 90

CA

$\phi_b/2V$

(d)  $n=55$  to  $90$  deg,  $SR=0$ .  
 Figure A80.-Continued.

#133

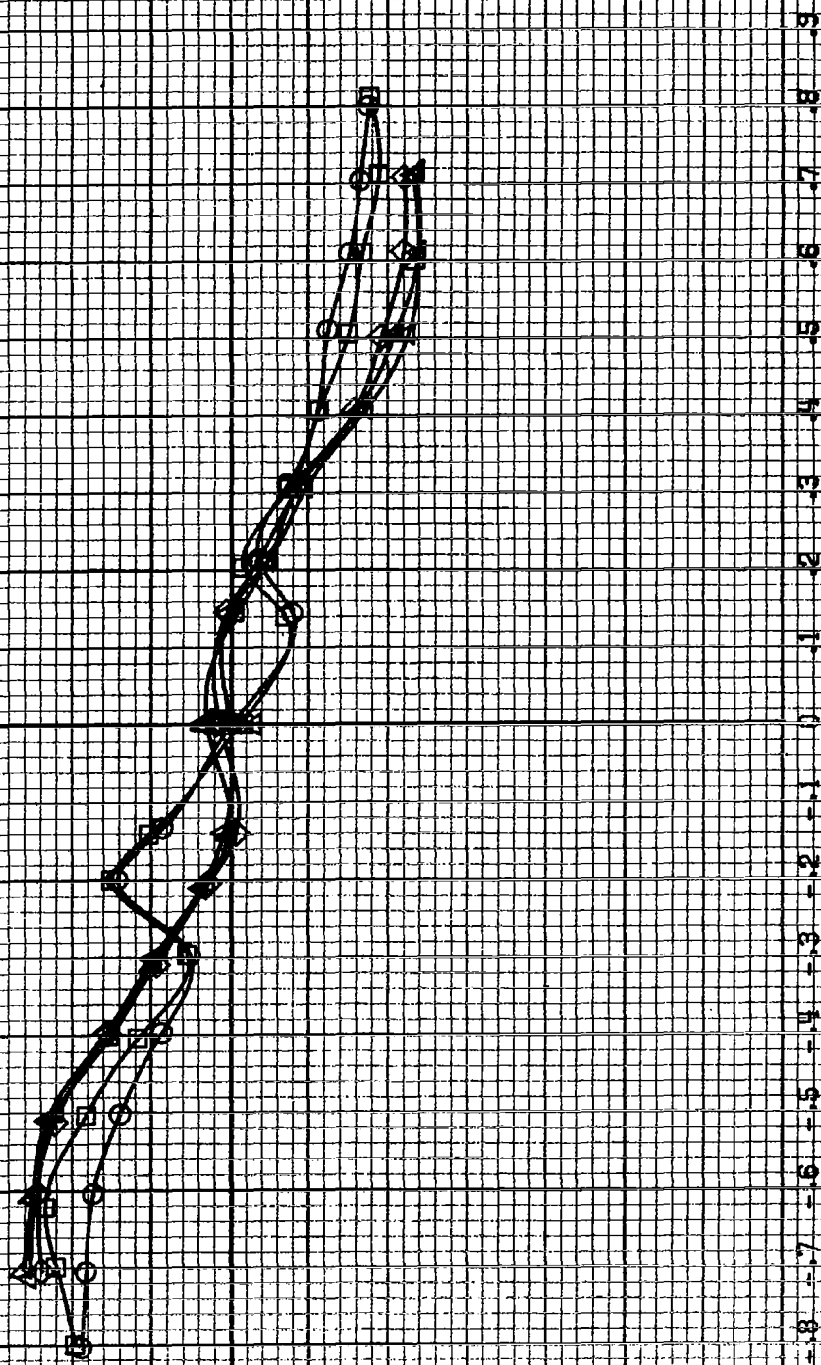
$\alpha$ , deg  
 ○ 8  
 □ 10  
 ◇ 12  
 △ 14  
 ▲ 16

$C_{l,n}$

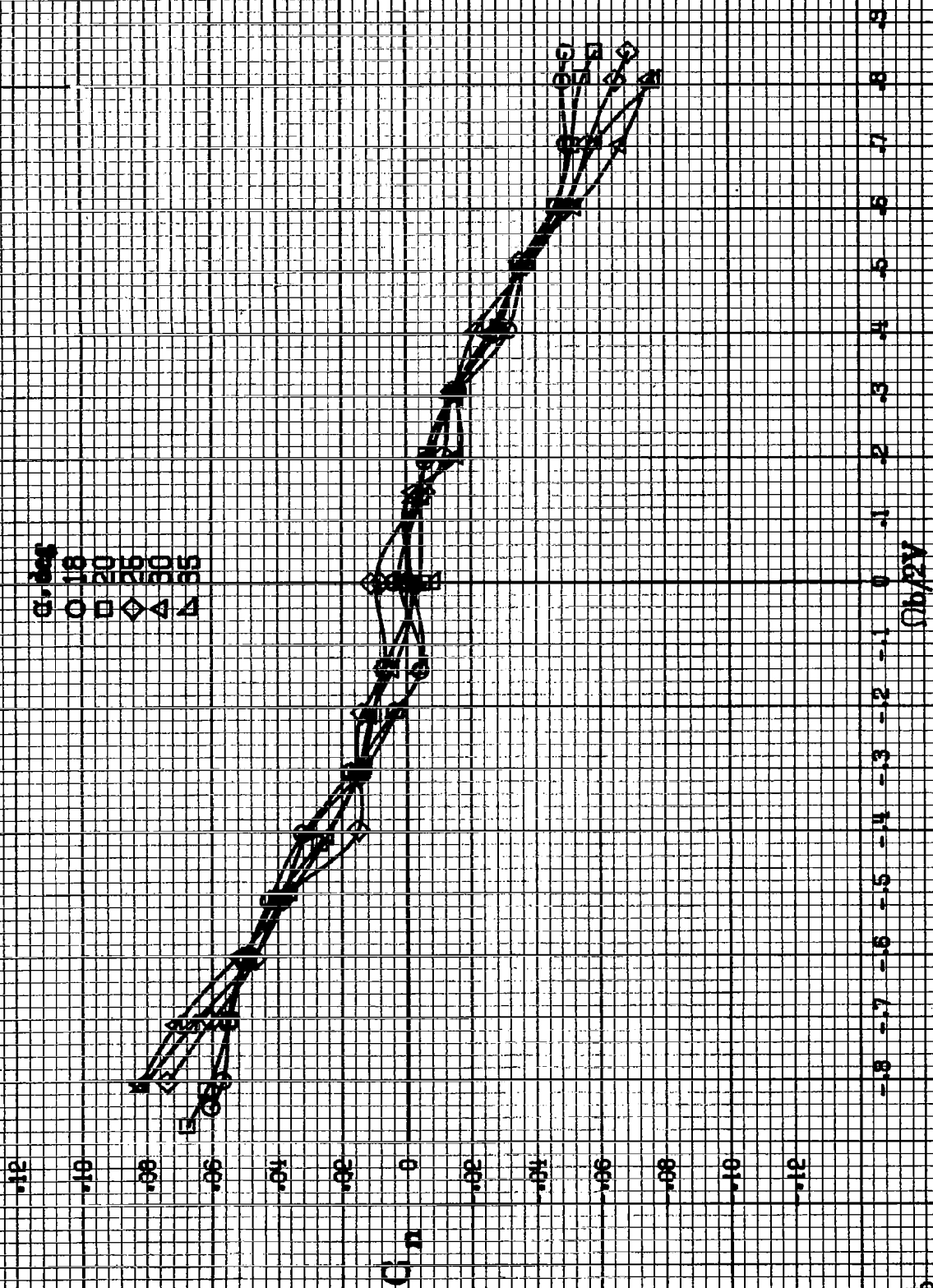
$Qb/2V$

(a)  $\alpha = 8$  to  $16$  deg,  $SR = 182.9$  cm (72 in.).

Figure A31. Effect of rotation rate and angle of attack on yawing-moment coefficient for full-span LE wing droop with moderate nose radius.  $\delta = 0^\circ$ ,  $\beta = 0^\circ$ .







(b)  $\alpha = 1810.55 \text{ deg}$ ,  $SR = 182.9 \text{ cm (72 in.)}$ .  
Figure A.81-Continued.

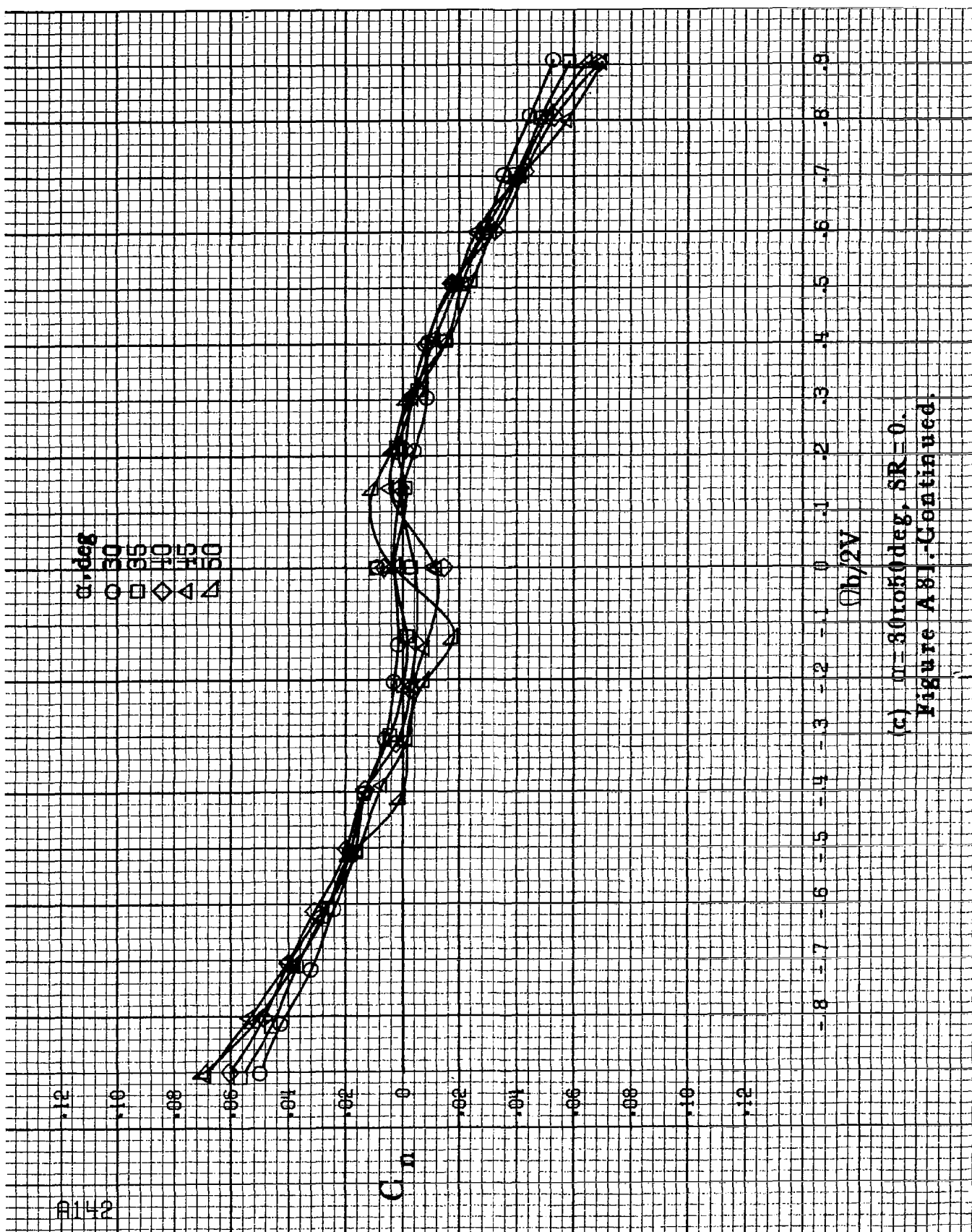
0142

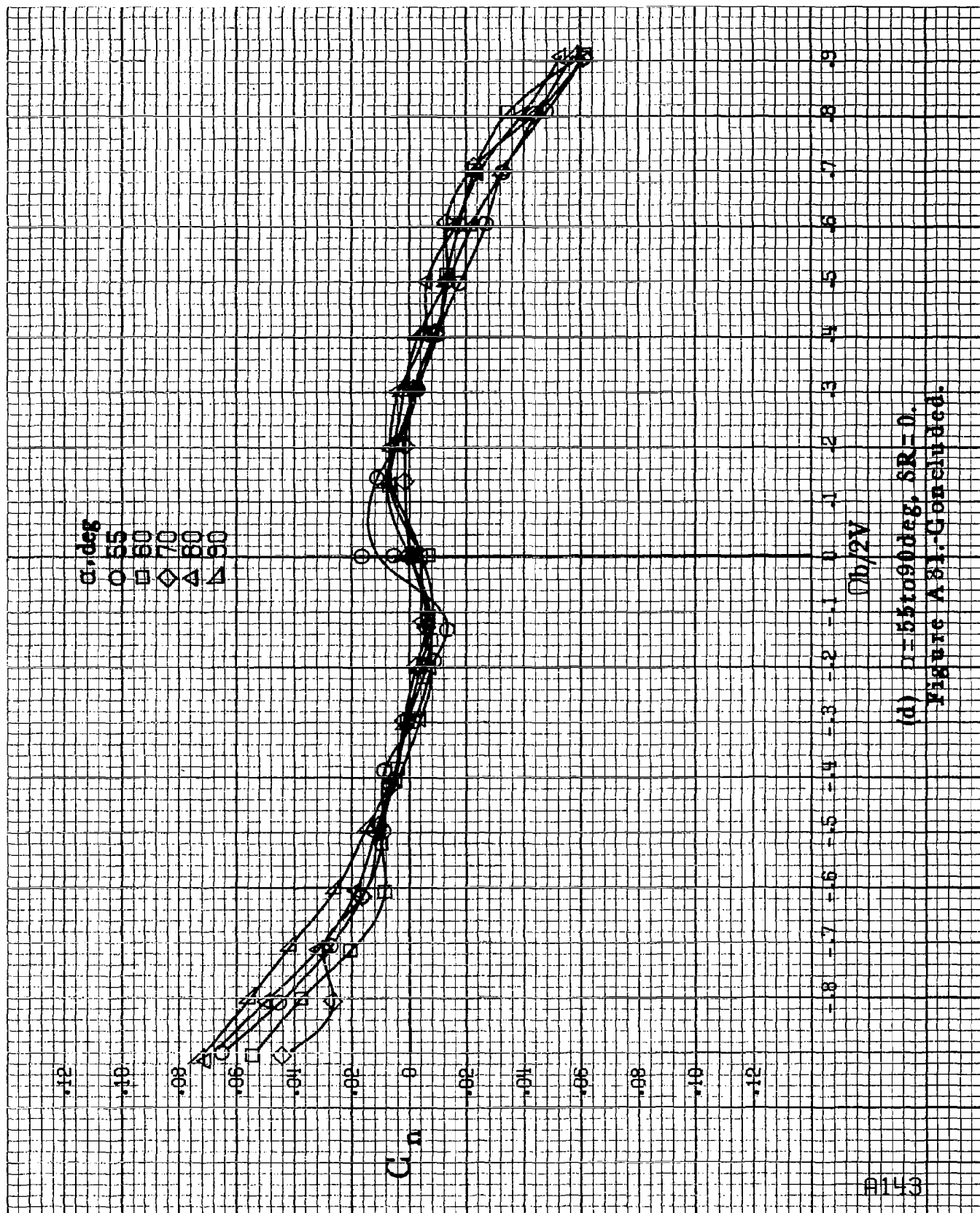
$\alpha, \text{deg}$   
 ○ 30  
 □ 55  
 ◇ 40  
 △ 45  
 ▽ 50

$C_m$

$\phi_b/2V$

(c)  $m=30$  to  $50 \text{ deg}$ ,  $SR=0$ .  
 Figure A81.-Continued.





(d)  $\alpha = 55$  to  $90$  deg,  $SR = 0$ .  
Figure A81. Continued.

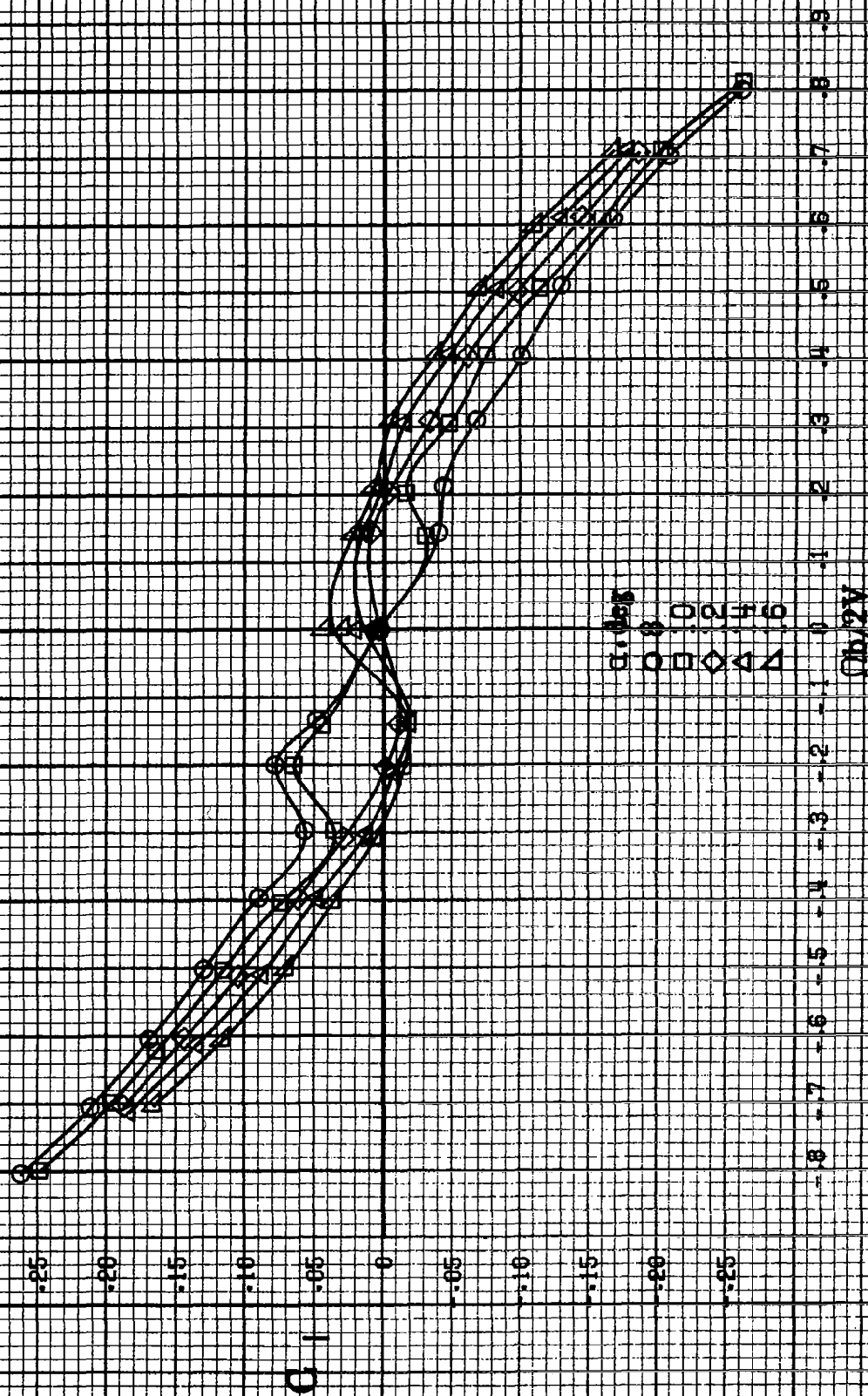
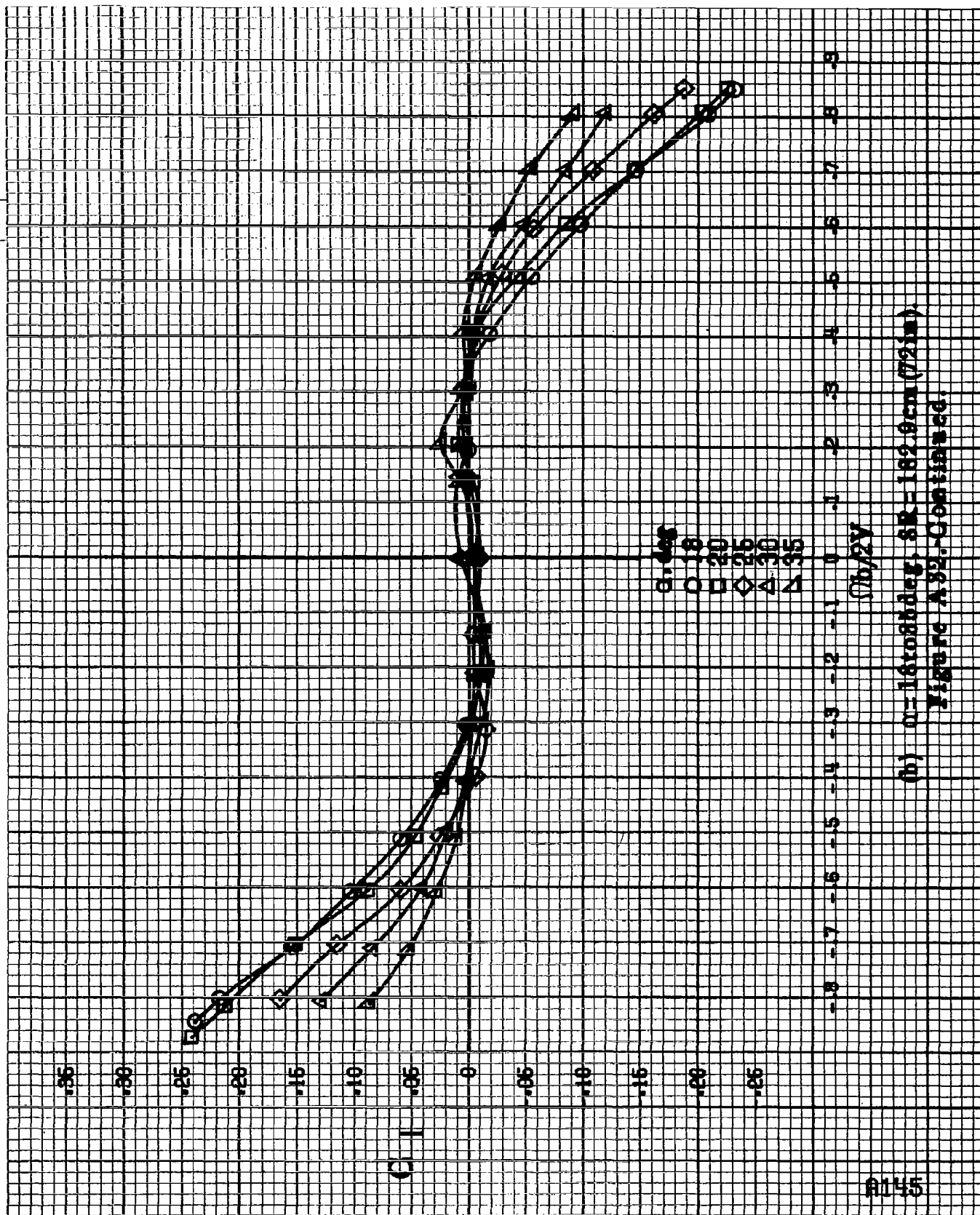
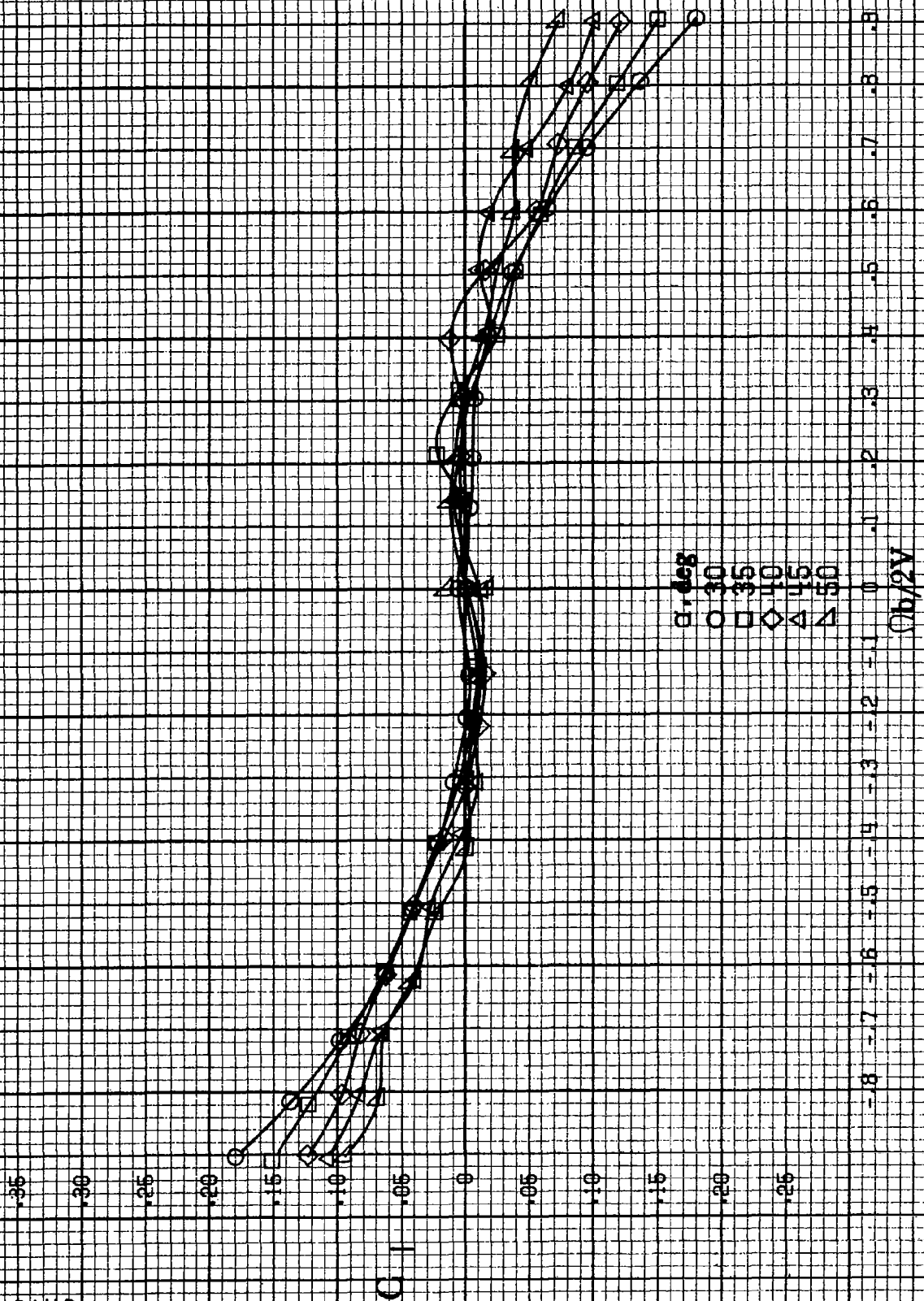


Figure A32. Effect of rotation rate and angle of attack on rolling-moment coefficient for full-span LE wing drop with moderate nose radius.  $\delta_n = 10^\circ$ ,  $\delta_t = 0^\circ$ ,  $\beta = 0^\circ$ . (a)  $q = 81016 \text{ deg}$ ,  $SR = 182.9 \text{ cm} (72 \text{ in})$ .

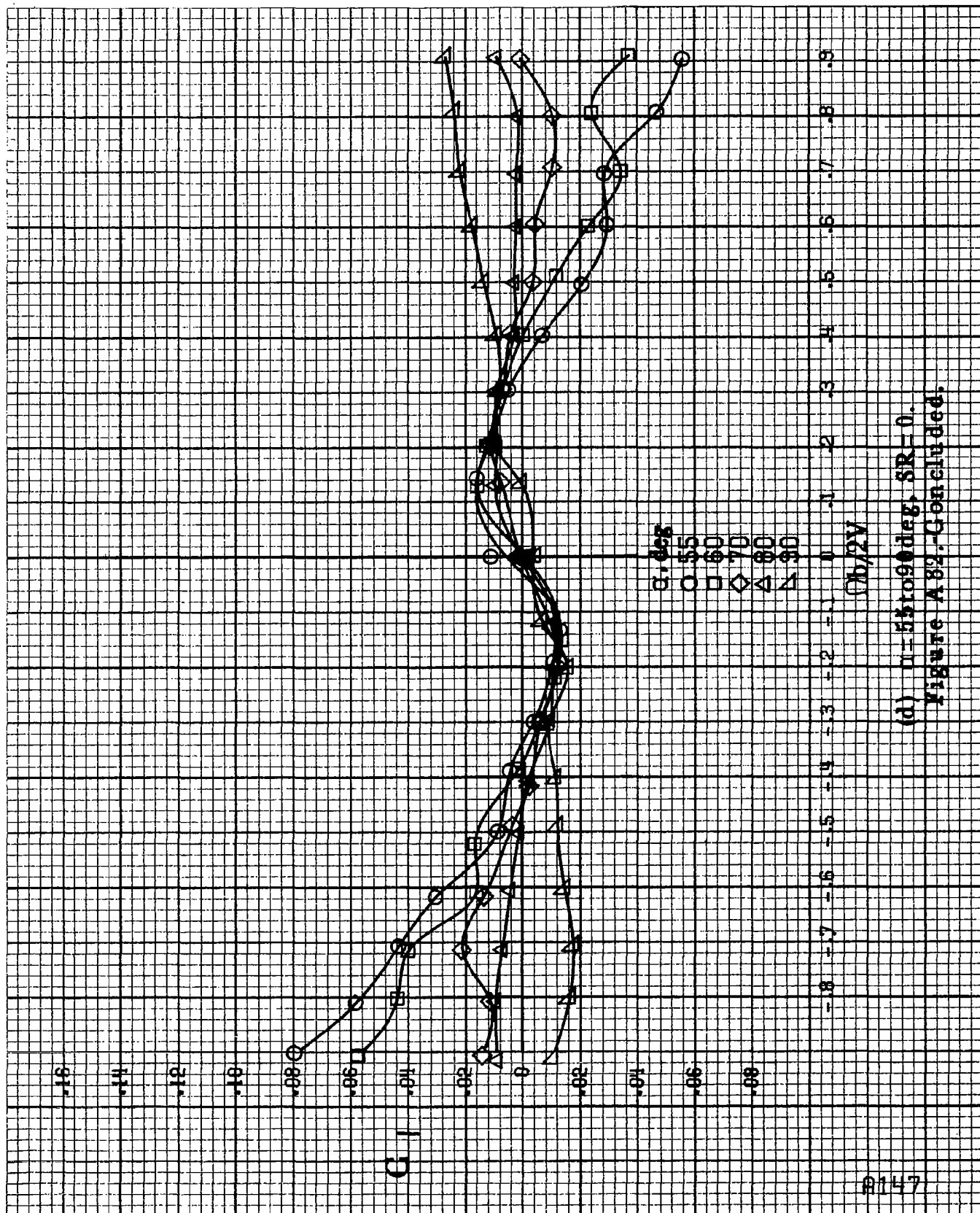


(b)  $\alpha = 16$  to  $86$  deg,  $SR = 182.9$  cm (72 in)

Figure A.32.-Continued.

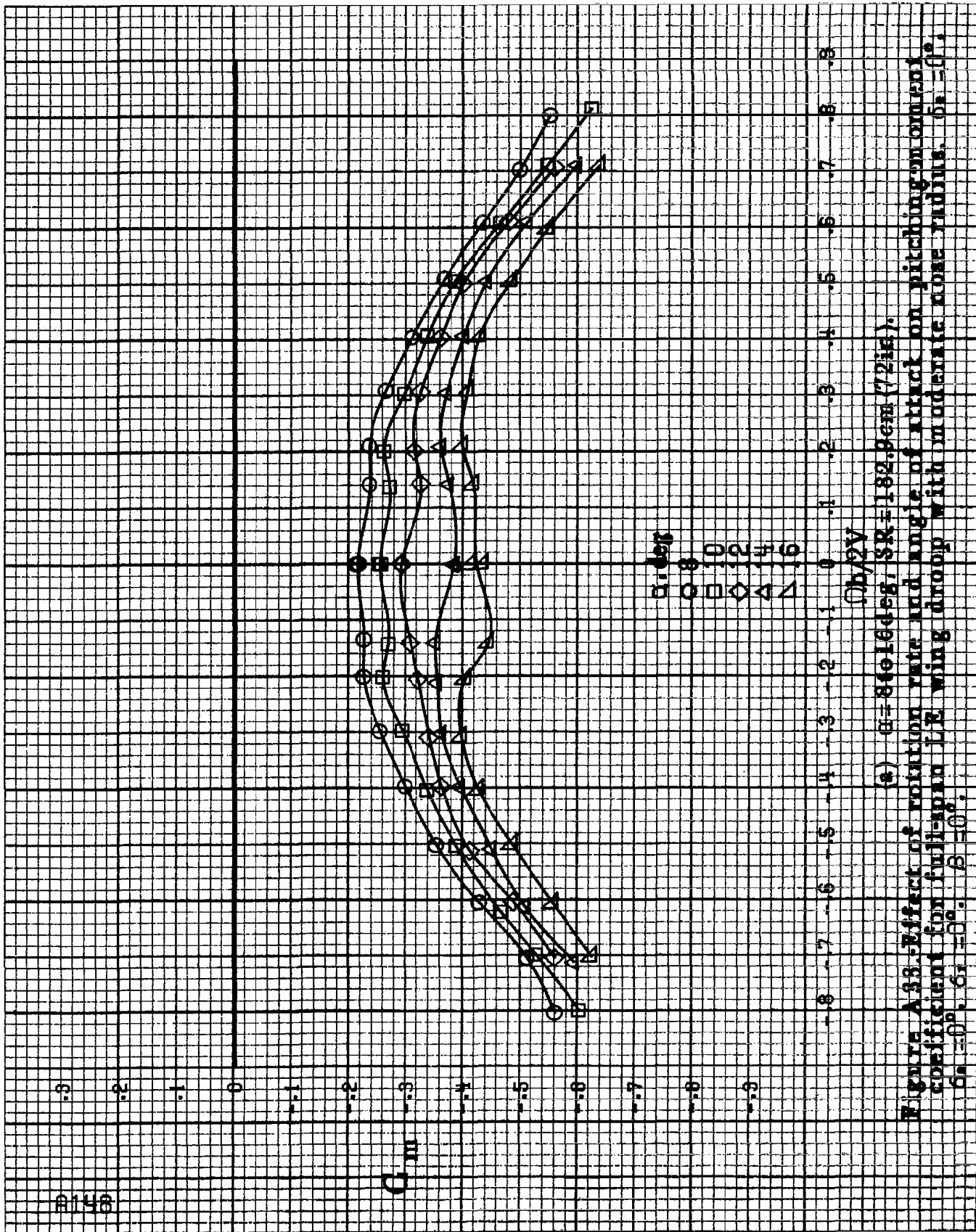


(c)  $\omega = 30$  to  $50$  deg,  $SR = 0$ .  
Figure A82.-Continued.

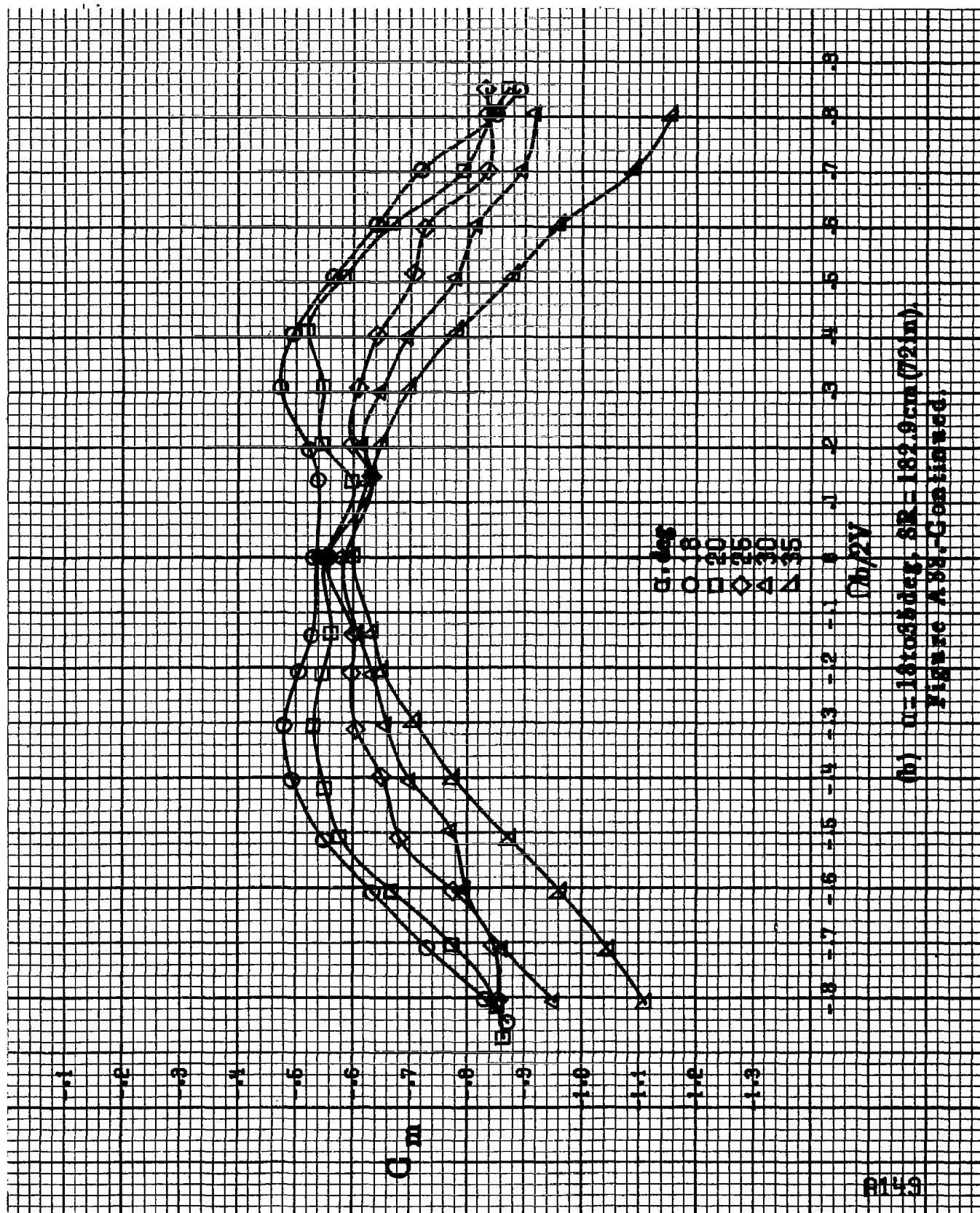


(d)  $\theta = 55$  to  $90$  deg,  $SR = 0$ .  
Figure A82.-Concluded.









R150

$C_m$

$\alpha, \text{deg}$

○ 30

□ 35

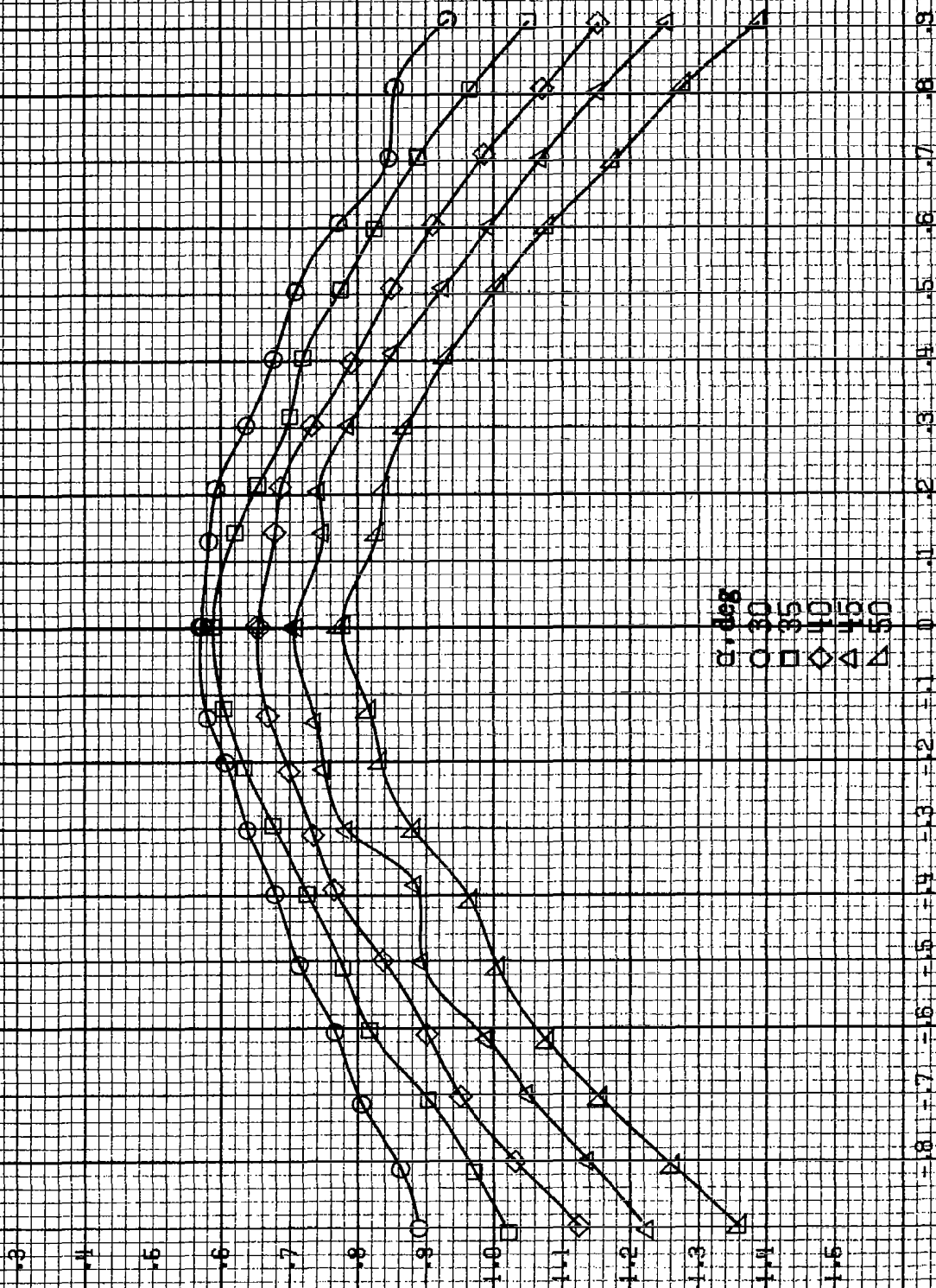
◇ 40

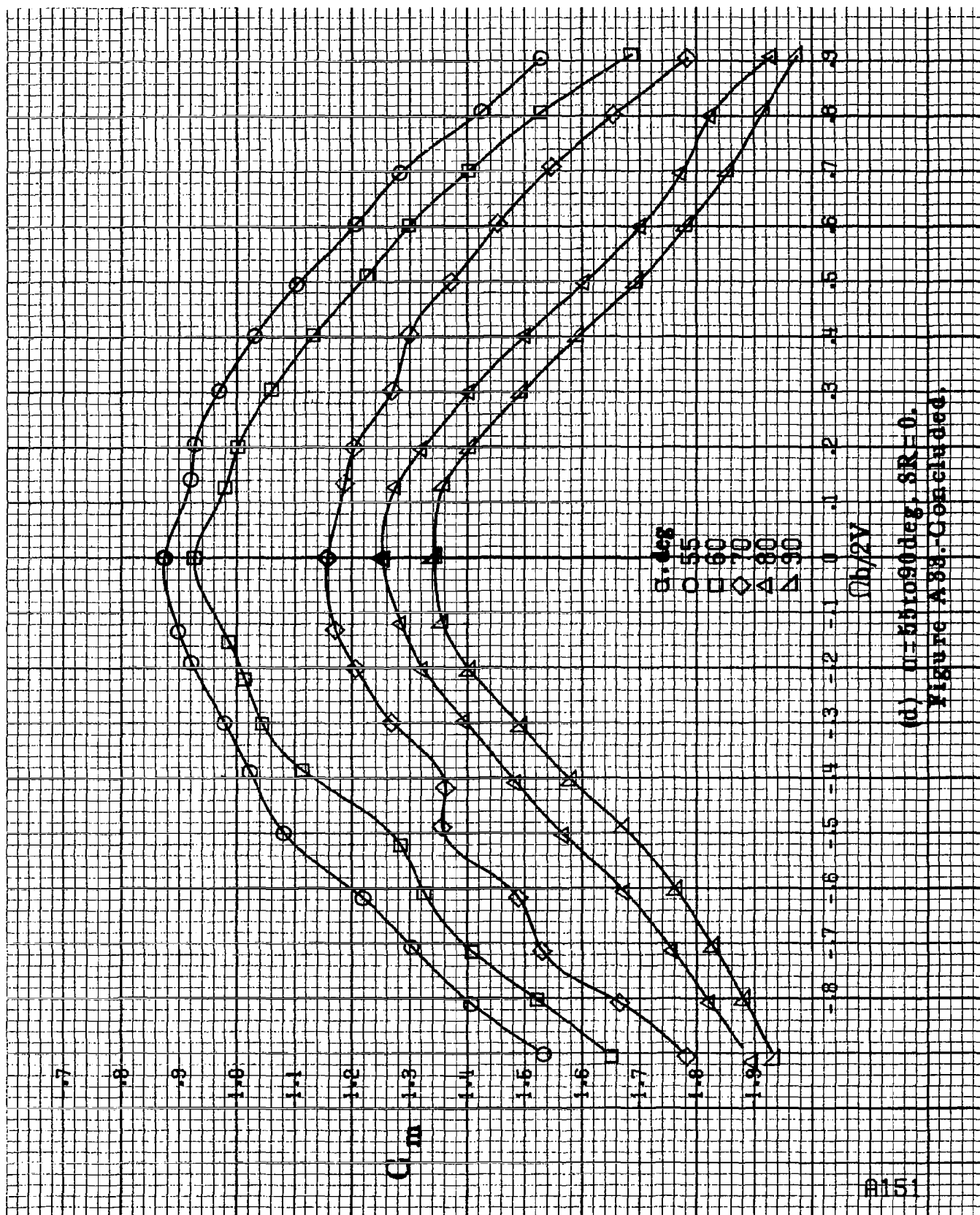
△ 45

▽ 50

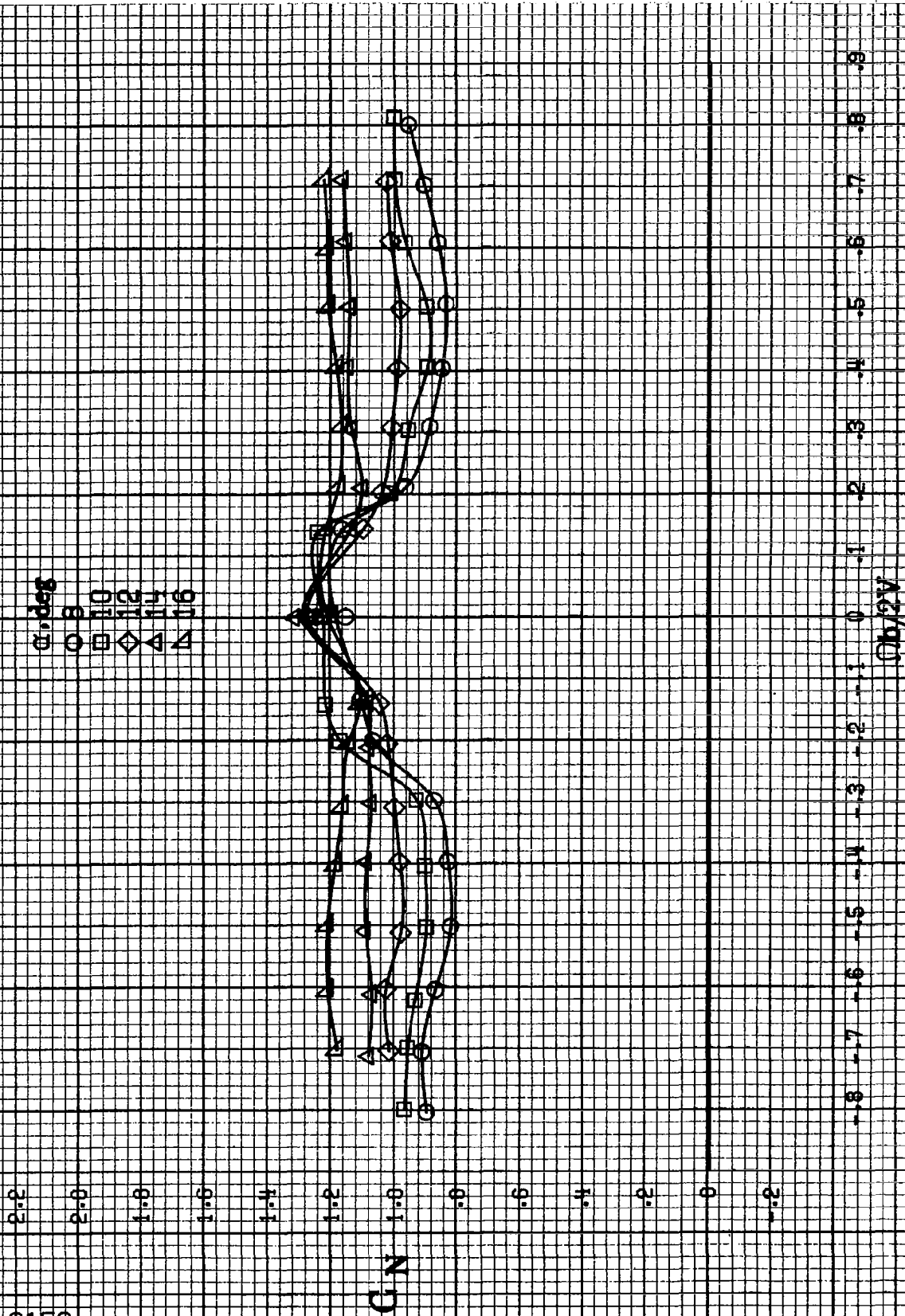
$C_b/2V$

(c)  $\alpha = 30$  to  $50$  deg,  $SR = 0$ .  
Figure A 88.-Continued.

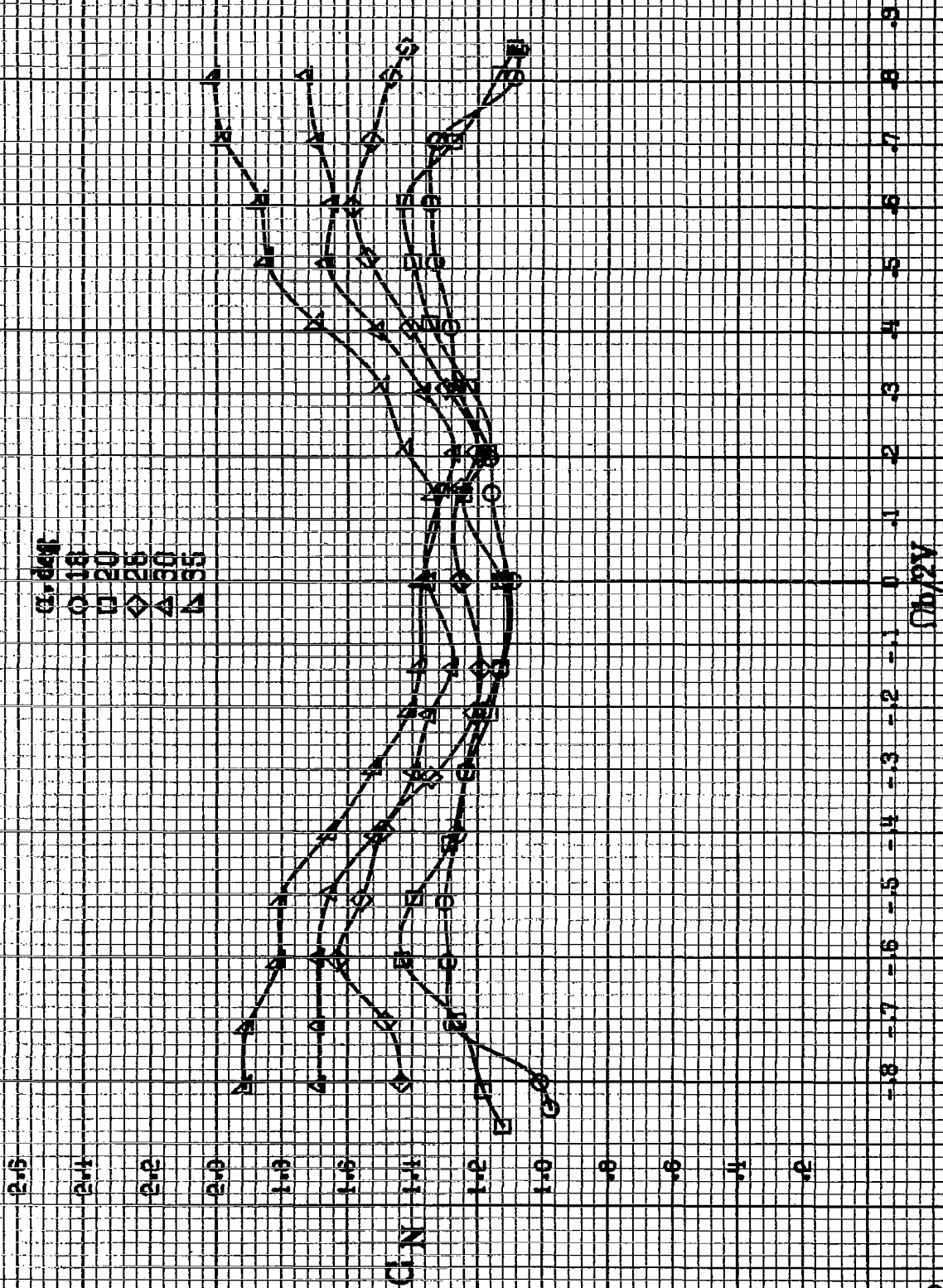




(d)  $\theta = 85$  to  $90$  deg,  $SR = 0$ .  
Figure A33. Concluded.



(a)  $\alpha = 8^\circ$  to  $16^\circ$  deg,  $SR = 1.82$ ,  $9\text{ cm}$  (72 in.).  
 Figure A34.-Effect of rotation rate and angle of attack on normal-force coefficient for full-span I-E wing droop with moderate nose radius.  $\delta_n = 0^\circ$ ,  $\delta_r = 0^\circ$ ,  $\beta = 0^\circ$ .



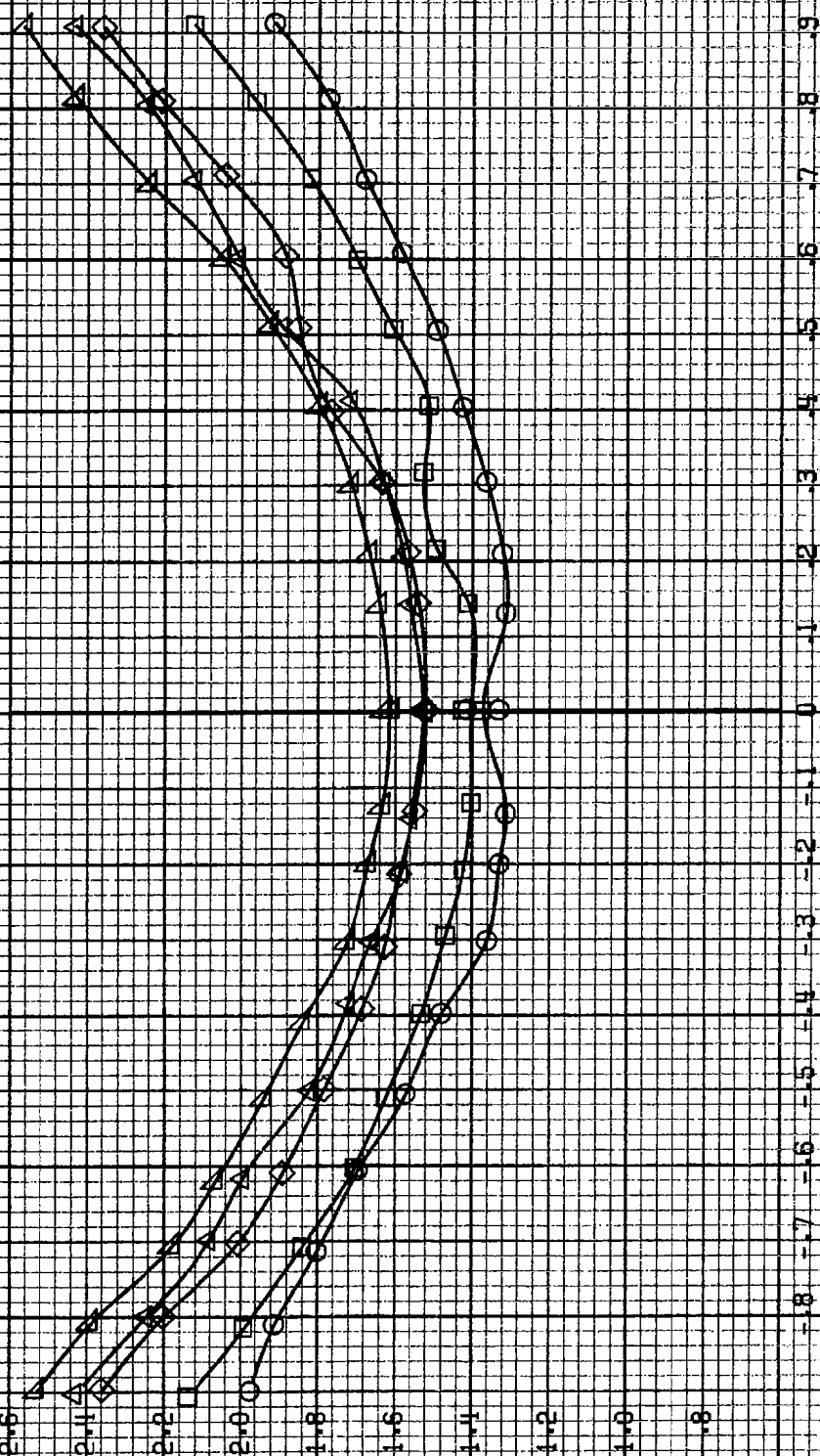
(b)  $\alpha = 1.8$  to  $5.5$  deg,  $SR = 1.62.9 \text{ cm} (72 \text{ in})$ .  
Figure A 84-Continued.

154

3.2  
3.0  
2.8  
2.6  
2.4  
2.2  
2.0  
1.8  
1.6  
1.4  
1.2  
1.0  
.8

C/N

$\alpha$ , deg  
○ 30  
□ 35  
◇ 40  
△ 45  
▽ 50



Oh/2V

(c)  $\alpha=30$  to  $50$  deg,  $SR=0$ .  
Figure A34.-Continued.

$\alpha$ , deg  
 ○ 55  
 □ 60  
 ◇ 70  
 △ 80  
 ▲ 90

$C'N$

$Ob/2V$

(d)  $\alpha = 55$  to  $90$  deg,  $SR = 0$ .  
 Figure A 84.-Concluded.



#156

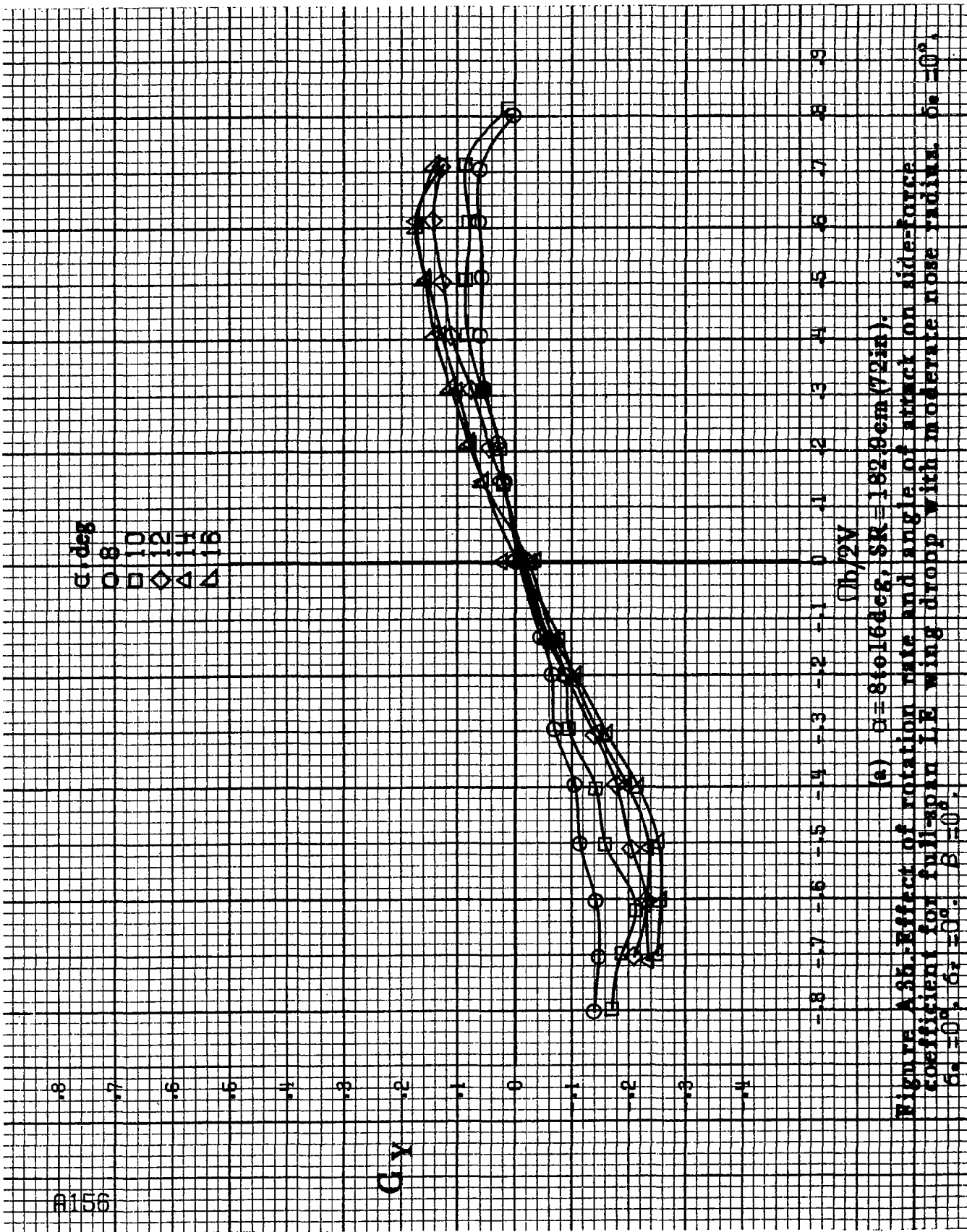
$\alpha, \text{deg}$   
 0 8 10 12 14 16  
 ○ □ ◇ △ ▽

$C_y$

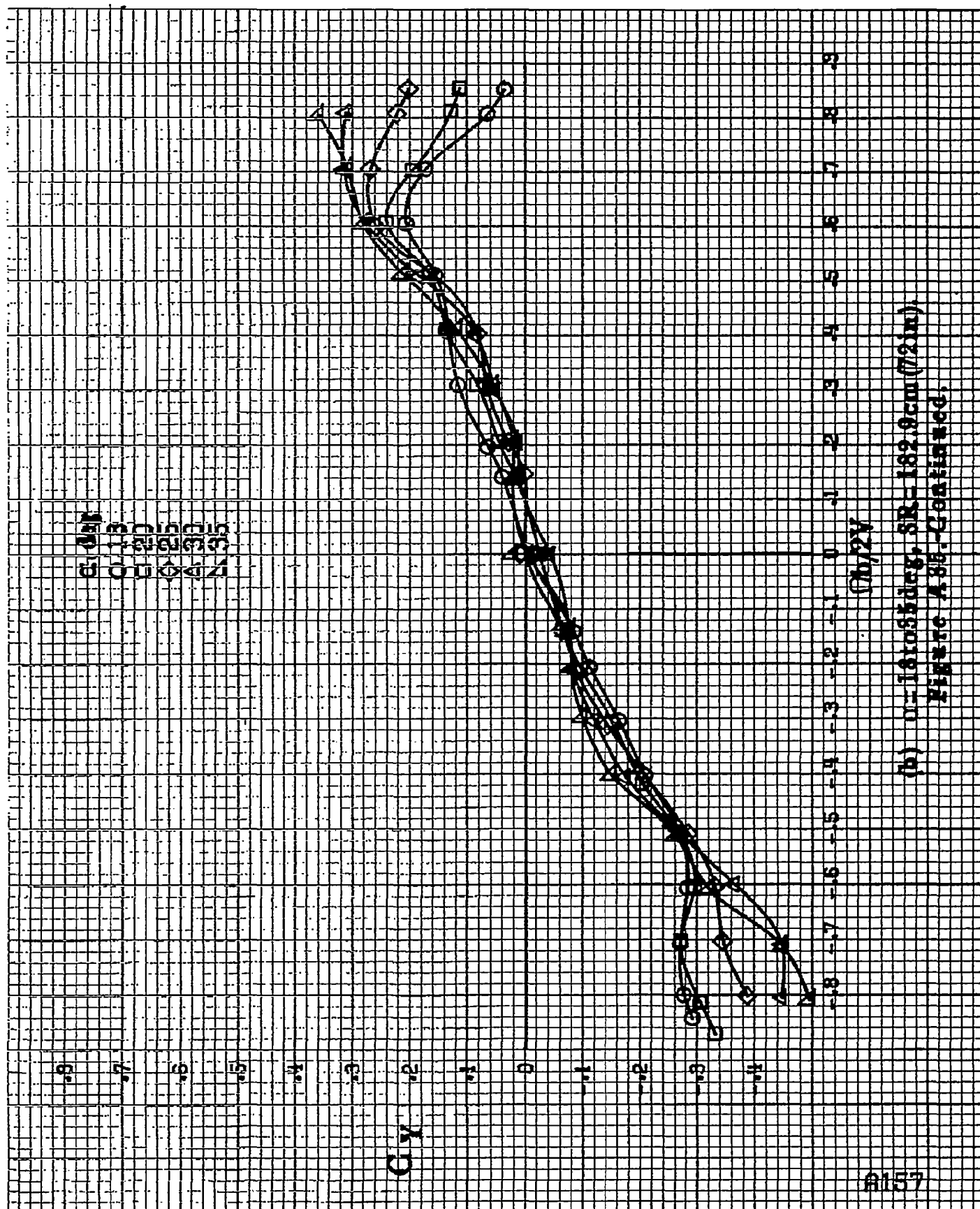
$C_{D,2V}$

(a)  $\alpha = 8 \pm 0.16 \text{ deg}$ ,  $SR = 182.9 \text{ cm (72 in)}$ .

Figure A35. Effect of rotation rate and angle of attack on side-force coefficient for full-span LE wing droop with moderate nose radius.  $\delta = 10^\circ$ ,  $\delta_n = 0^\circ$ ,  $\delta_r = 0^\circ$ .







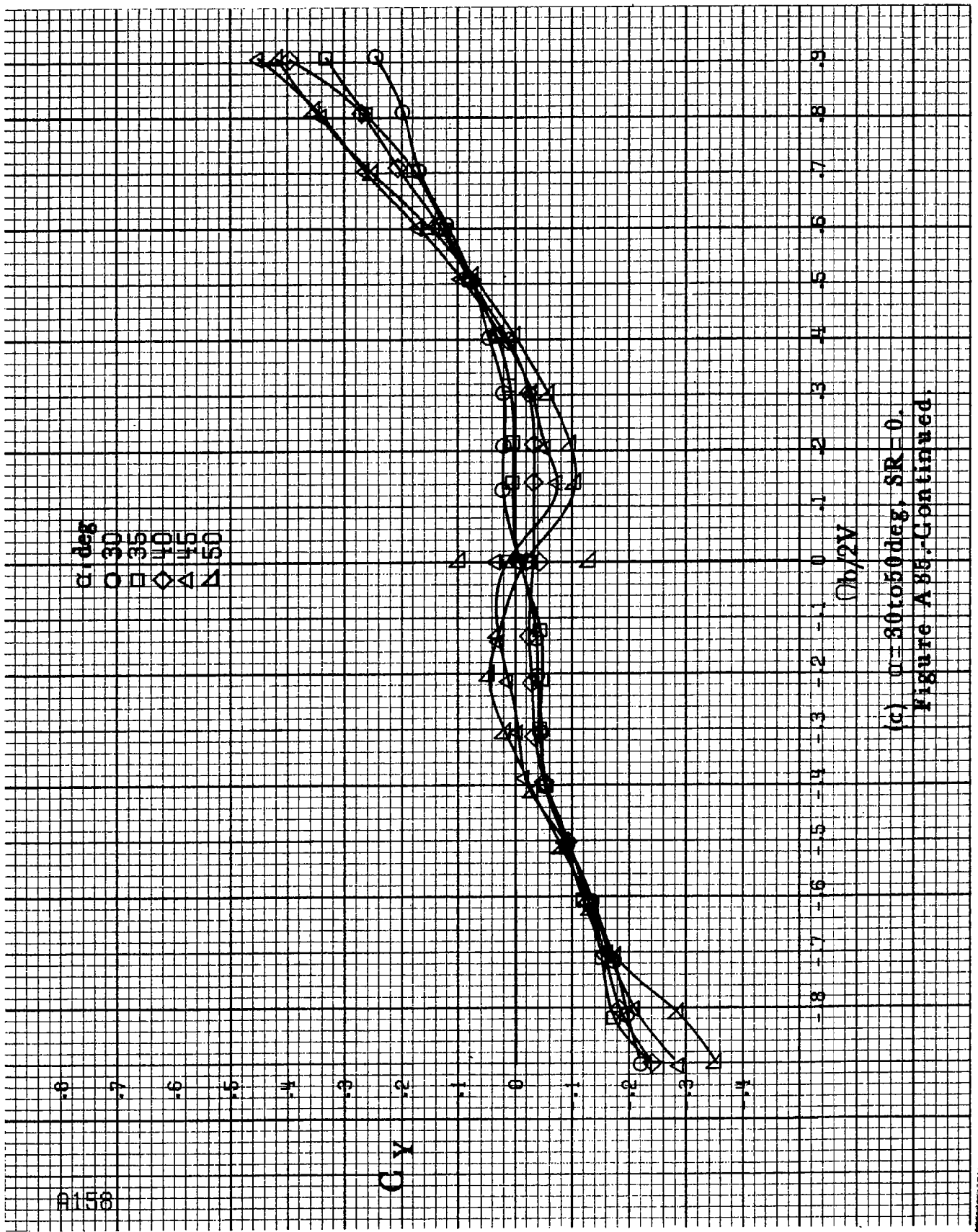
(b)  $n=1.61085^\circ$ ,  $SR=162.9\text{cm (72in)}$ .  
Figure A38-Continued.

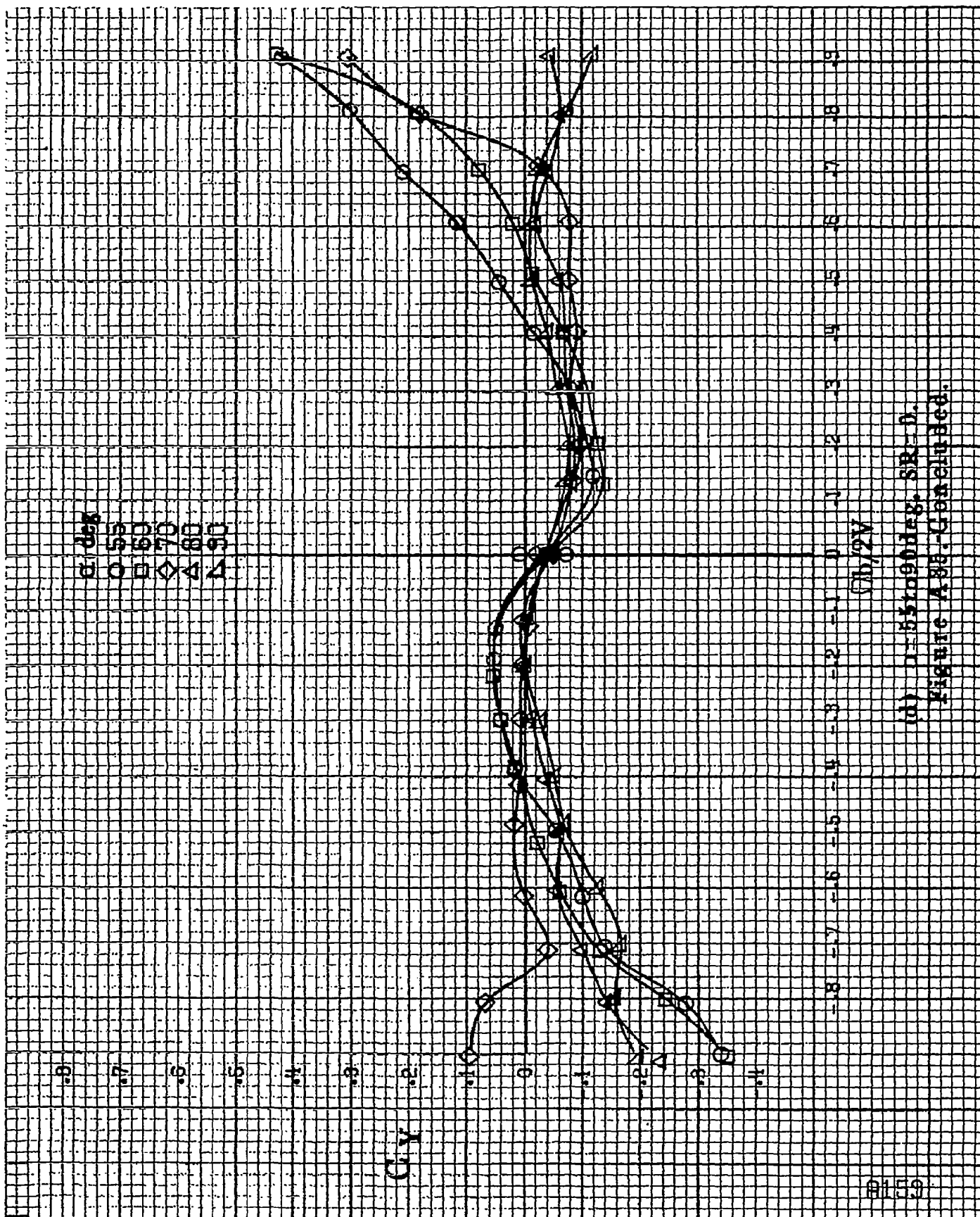
$\alpha, \text{deg}$   
 O 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▲ 50

$C_Y$

$\phi_b/2V$

(c)  $\mu = 30 \text{ to } 50 \text{ deg}$ ,  $SR = 0$ .  
 Figure A88.-Continued.





#160

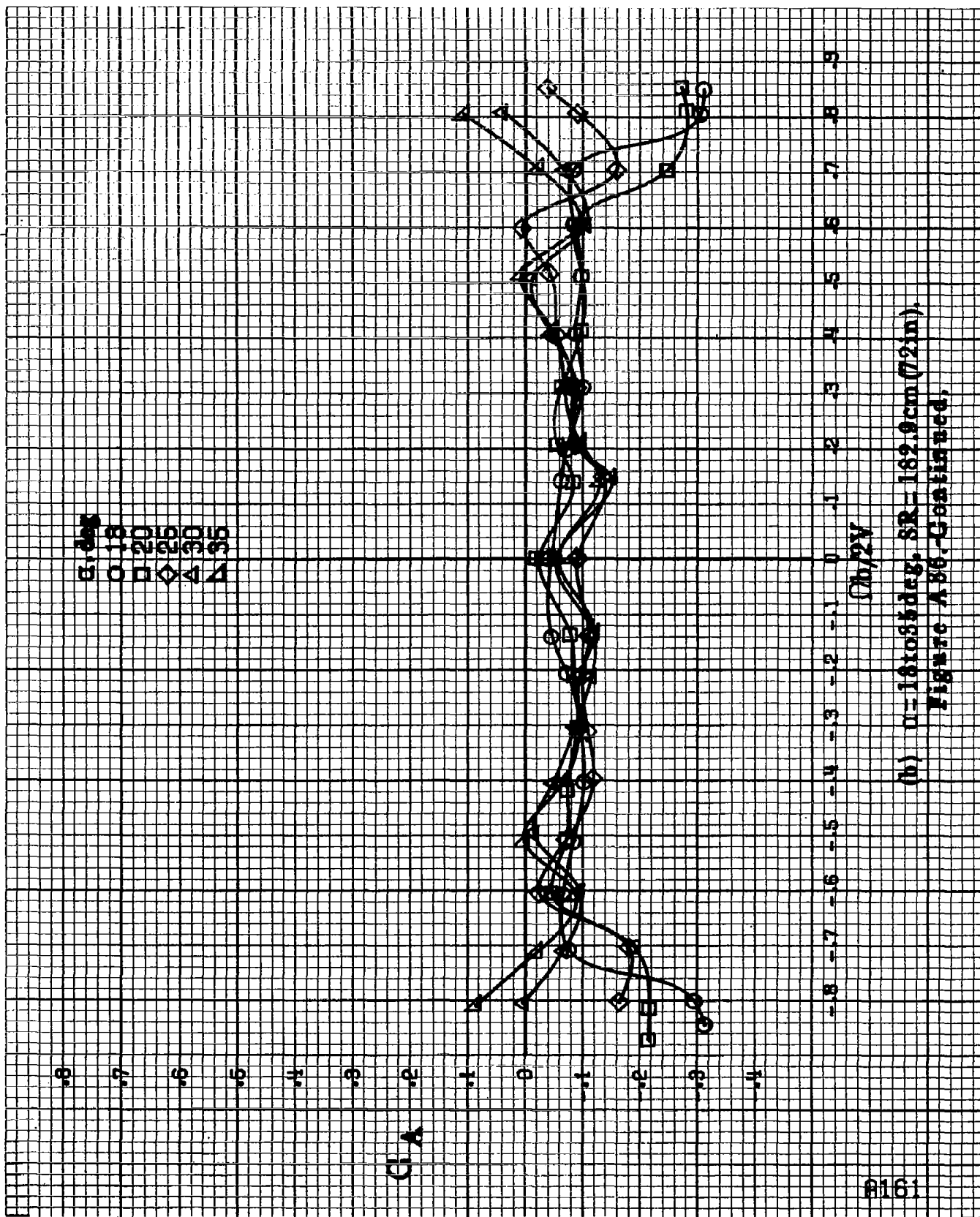
$\alpha$ , deg  
 8  
 10  
 12  
 14  
 16

$C_A$

$C_{D,2V}$

(a)  $\alpha = 8$  to  $16$  deg,  $SR = 182.9$  cm (72 in.).

Figure A38. Effect of rotation rate and angle of attack on axisi-force coefficient for full-span LE wing droop with moderate nose radius.  $\delta = 0^\circ$ ,  $\alpha_r = 0^\circ$ ,  $\beta = 0^\circ$ .



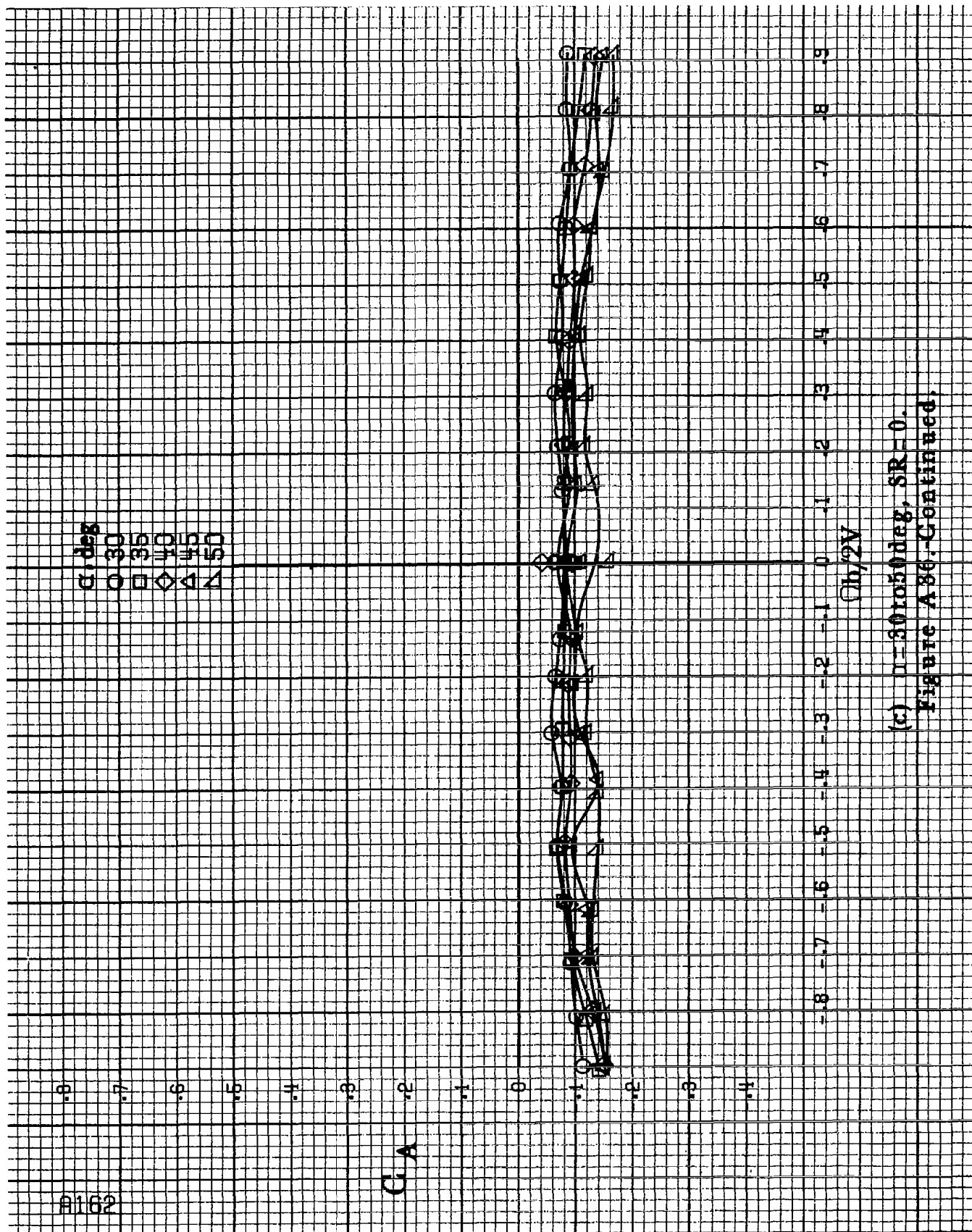
(b)  $\alpha = 18$  to  $55$  deg,  $SR = 162.9$  cm (72 in),  
Figure A 86, Continued.

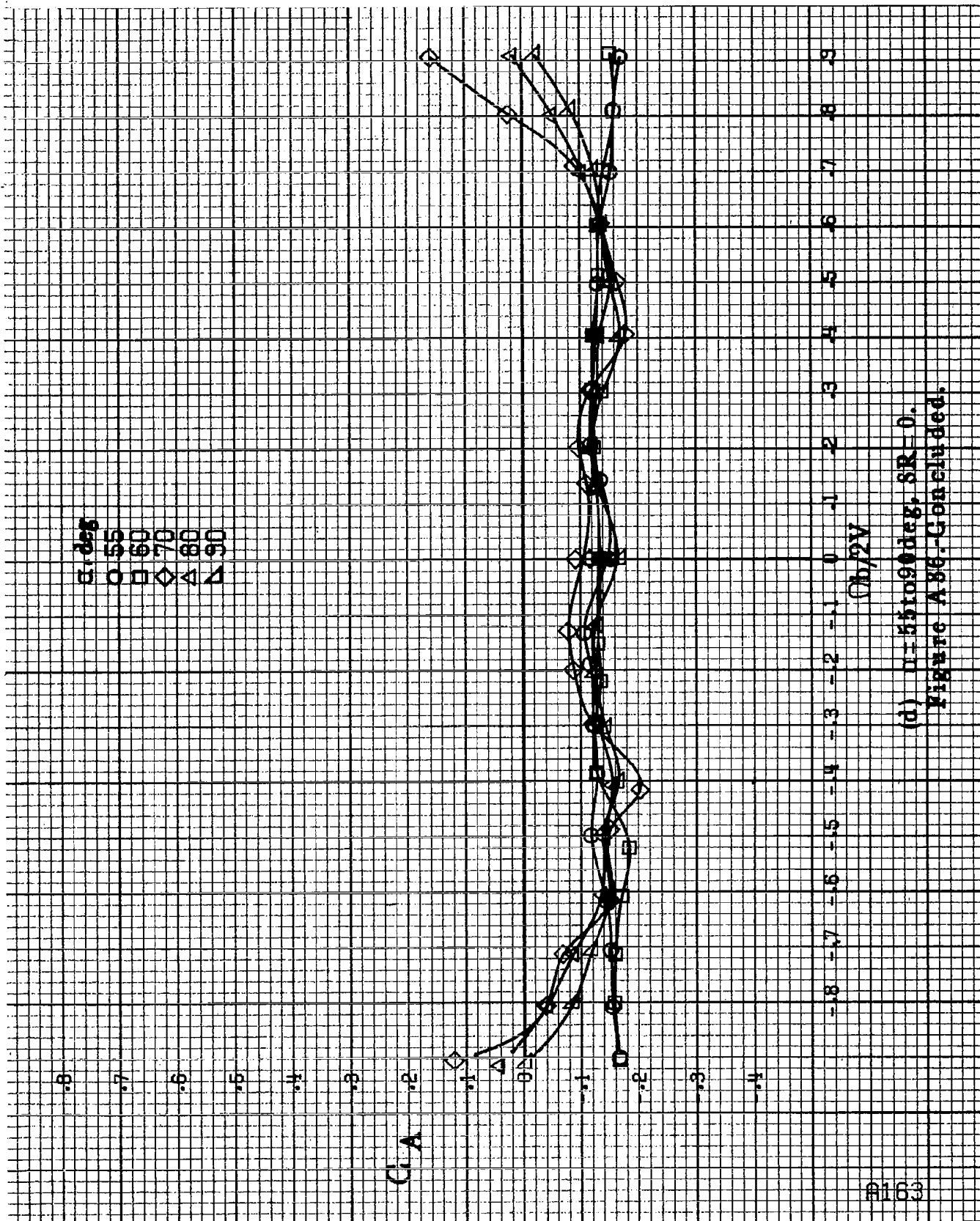
$\alpha$ , deg  
 ○ 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▽ 50

$C_A$

$Ch/2V$

(c)  $D=50$  to  $500$  deg,  $SR=0$ .  
 Figure A86-Continued.

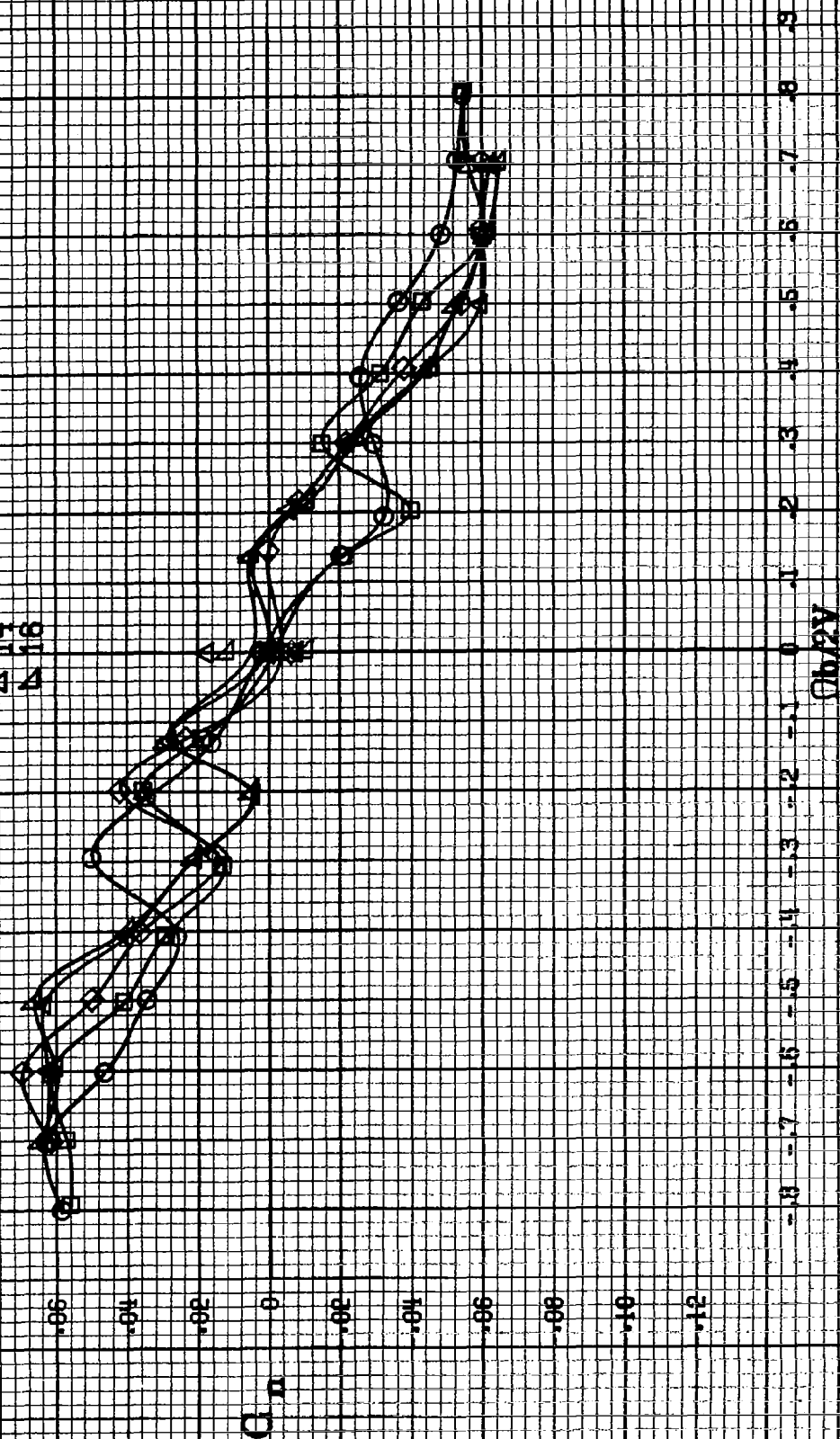




(d)  $\alpha = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A86.-Concluded.



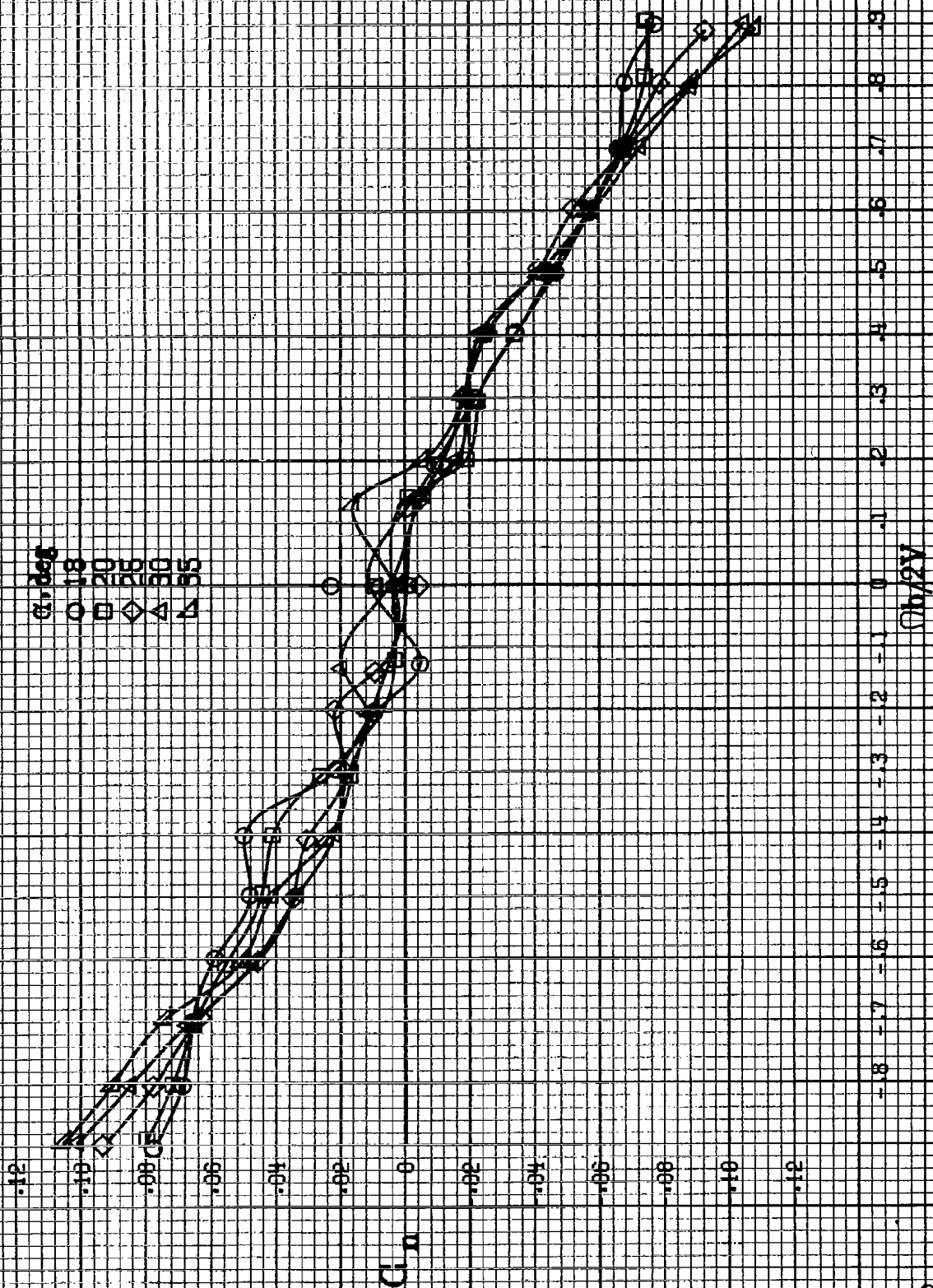
$\alpha, \text{deg}$   
 $\circ 8$   
 $\square 10$   
 $\diamond 12$   
 $\triangle 14$   
 $\nabla 16$



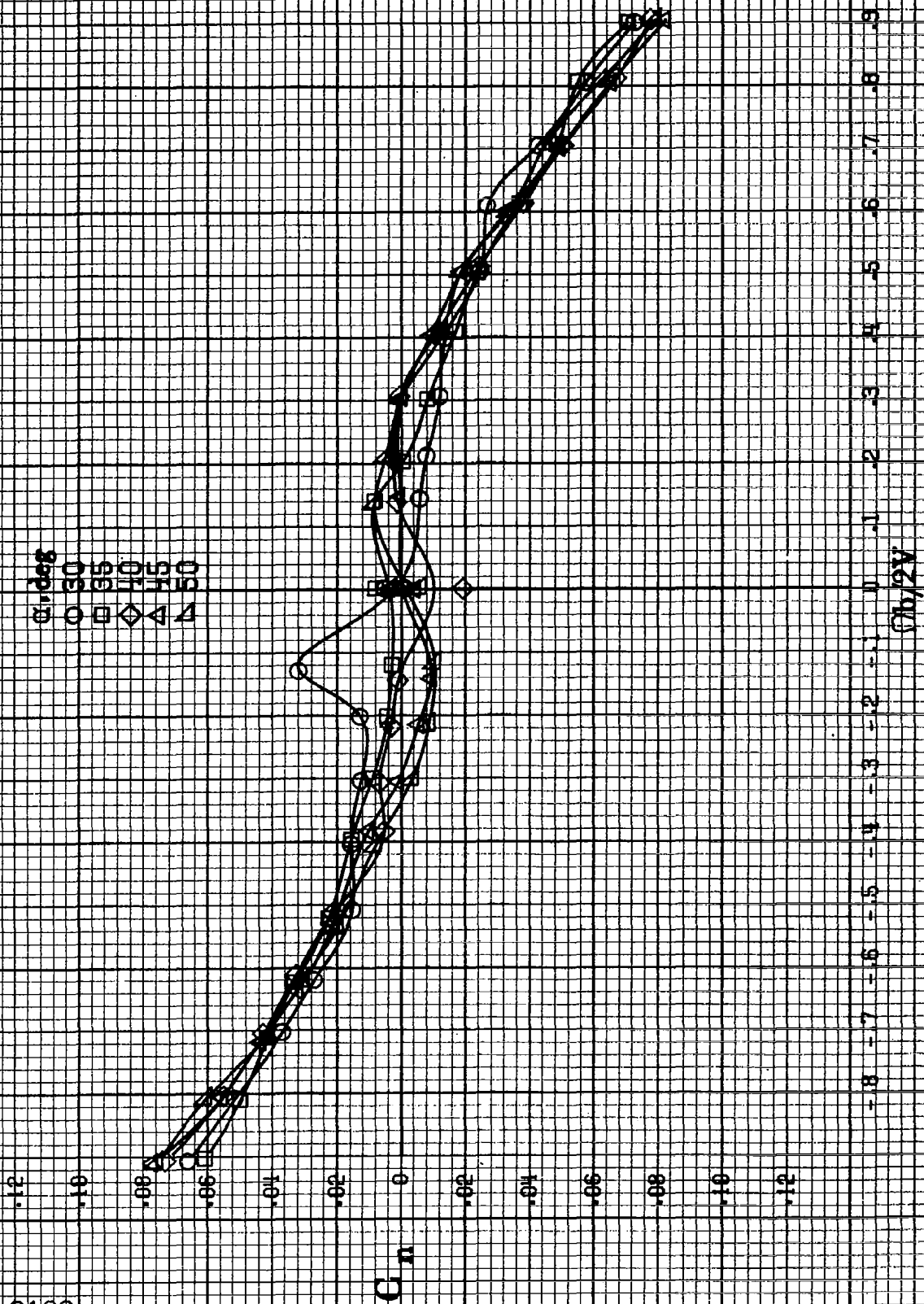
(a)  $\alpha = 8$  to  $16$  deg,  $SR = 1.82$  sem (72 in).

Figure A-37. Effect of rotation rate and angle of attack on yawing moment coefficient for full-span LK wing droop with large nose radius.  $\delta_n = 10^\circ$ ,  $\beta = 0^\circ$ .

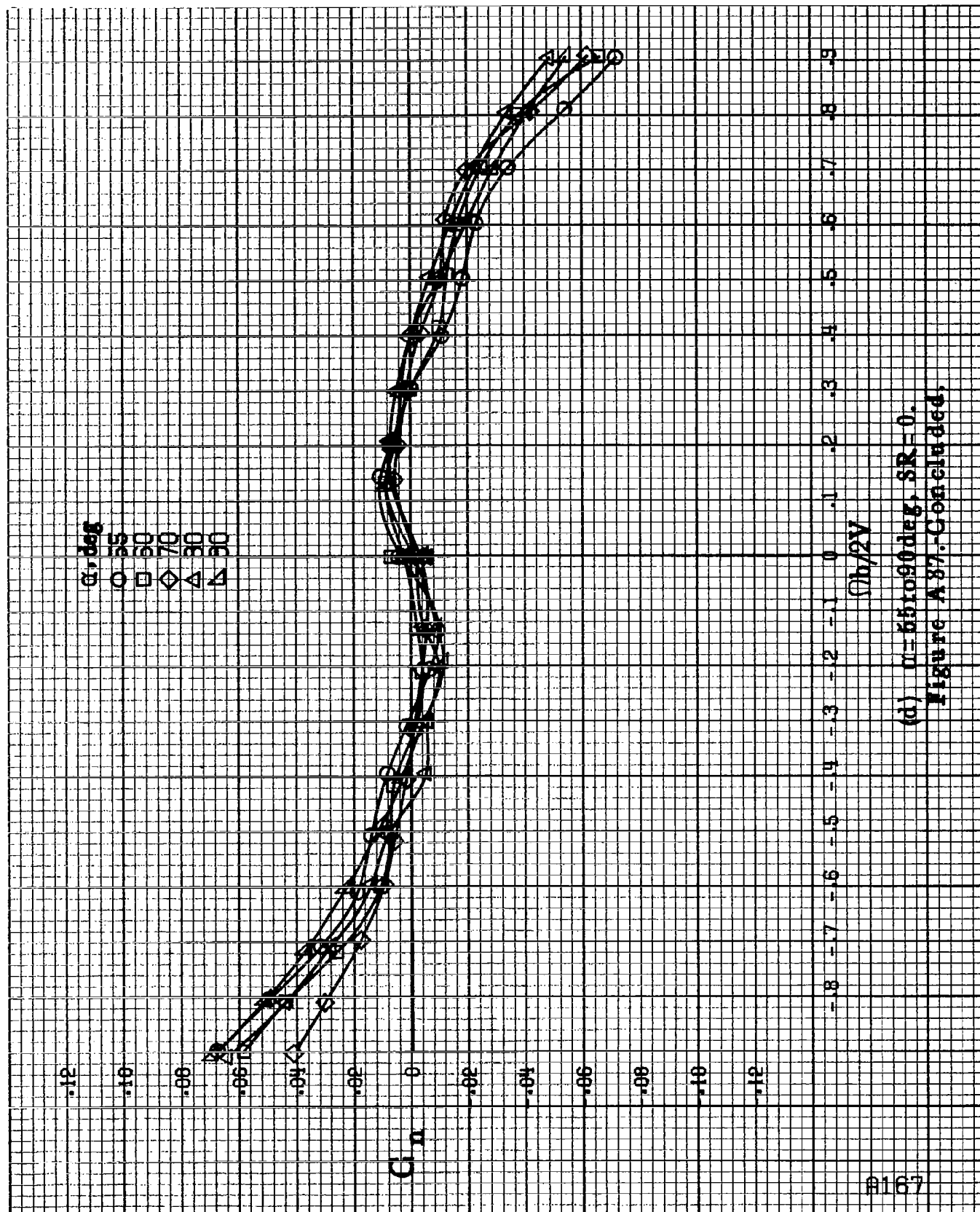




(b)  $\alpha = 18$  to  $35^\circ$ , SR = 182.9 cm (72 in).  
Figure A37-Continued.



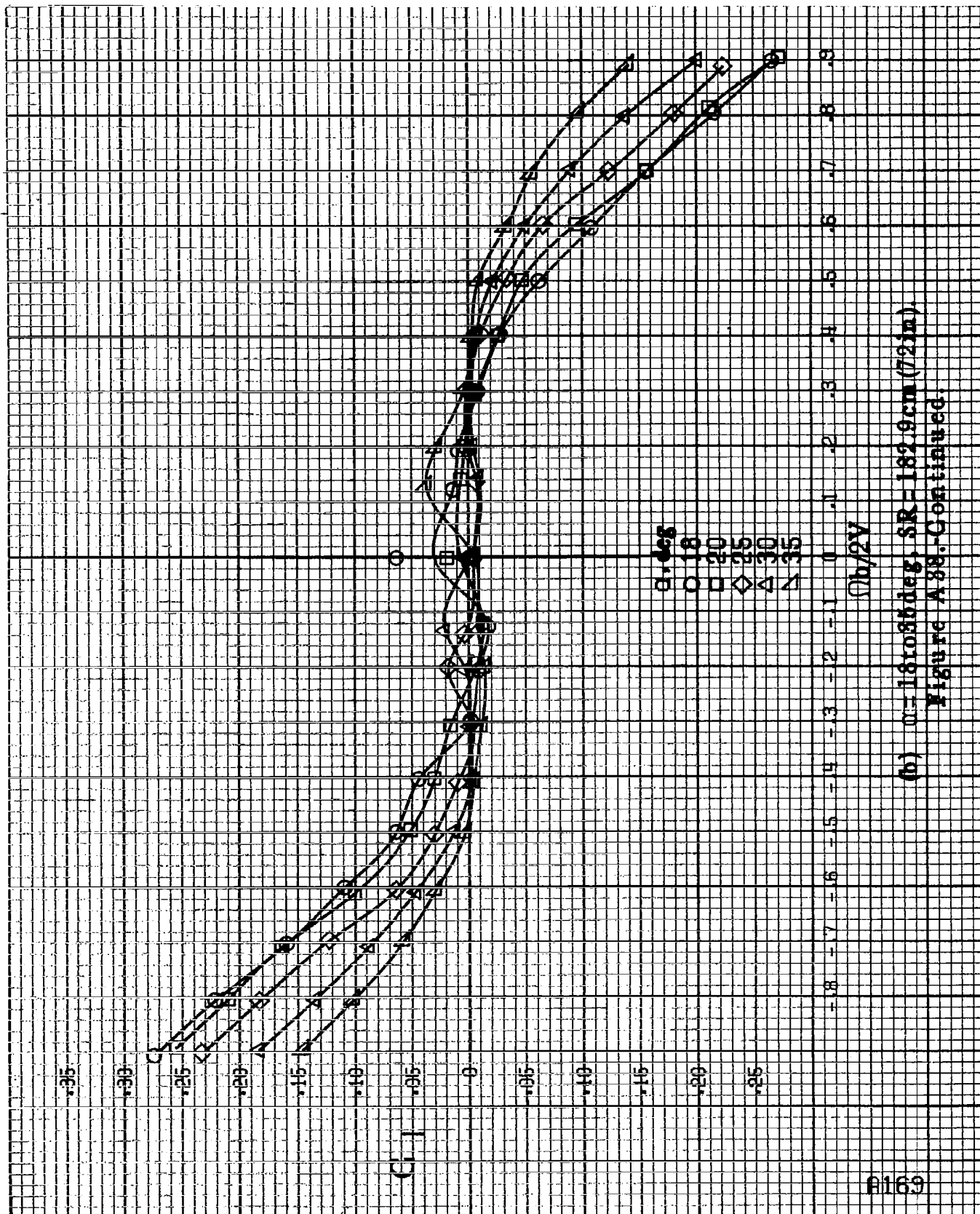
(c)  $\alpha = 30$  to  $50^\circ$ ,  $SR = 0$ .  
Figure A87-Continued.



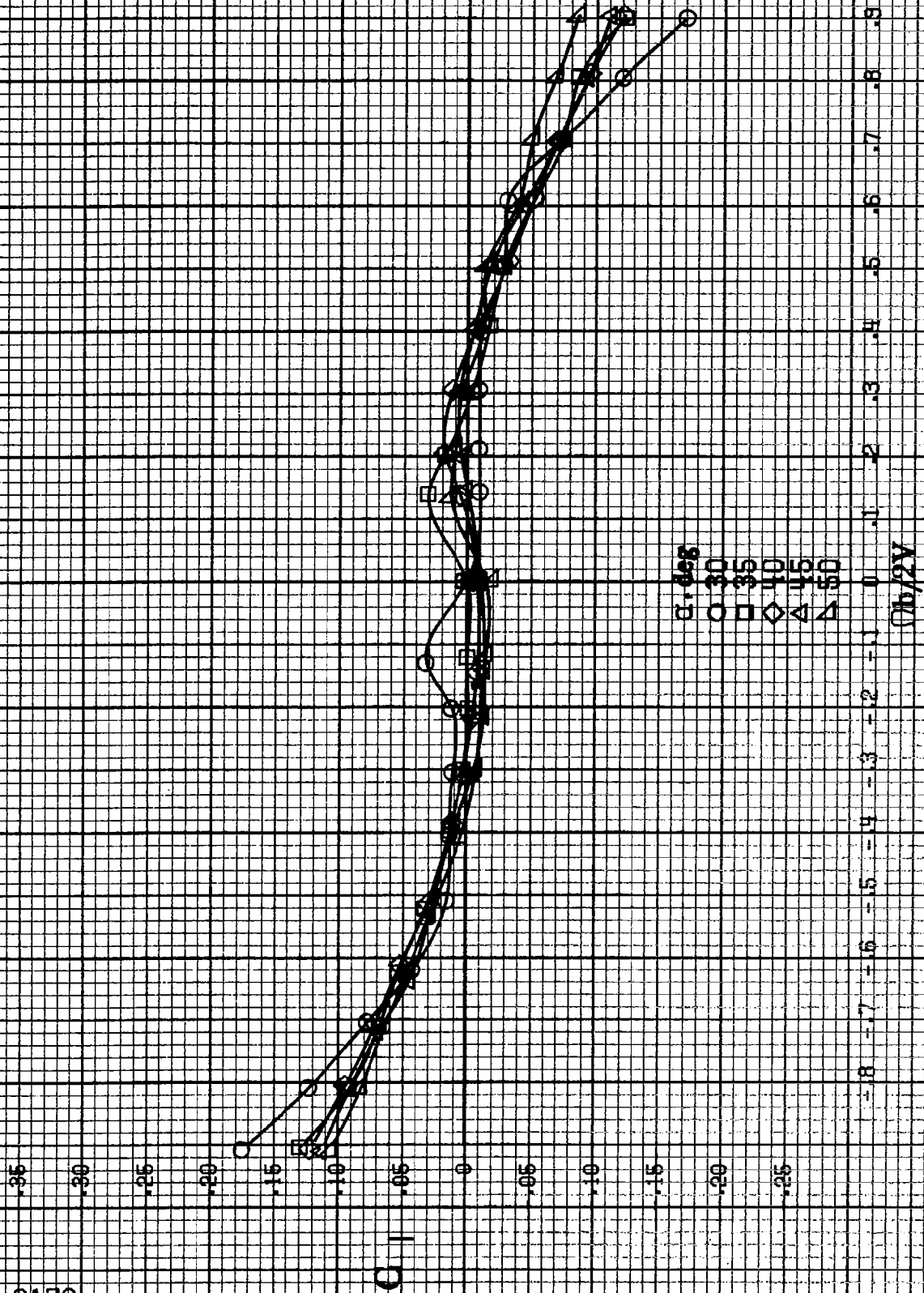
(d)  $\alpha = 55$  to  $90$  deg,  $SR = 0$ .  
Figure A 87.-Continued.



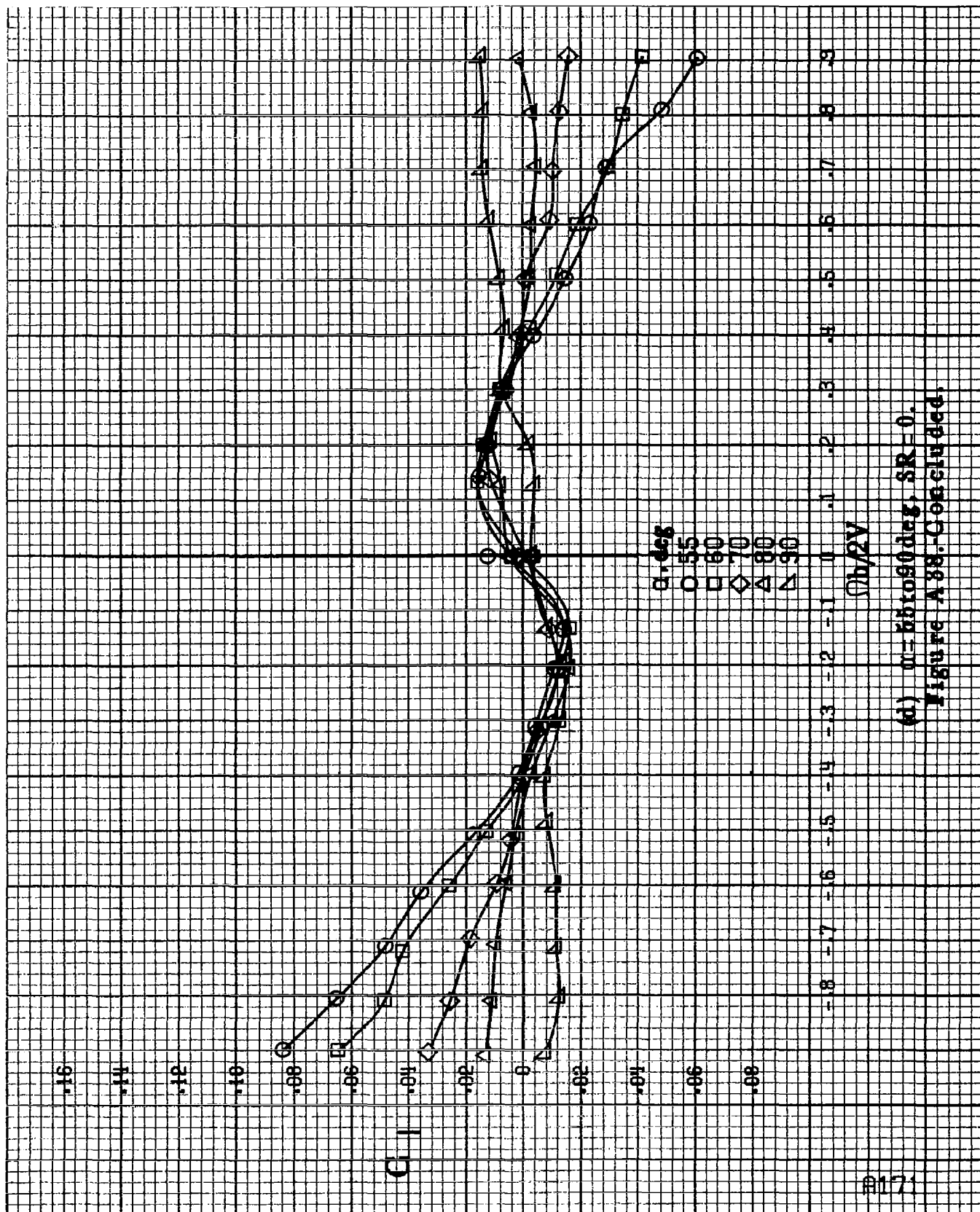
Figure A.20. Effect of rotation rate and angle of attack on rolling-moment coefficient for body with horizontal tail configuration.  $\delta\alpha = 0^\circ$ ,  $\beta = 0^\circ$ .  
(a)  $\alpha = 8$  to  $16$  deg,  $SR = 182.9$  cm (7.2 in).



(b)  $\alpha = 18$  to  $35$  deg,  $SR = 182.9 \text{ cm (72 in)}$ .  
Figure A38.-Continued.



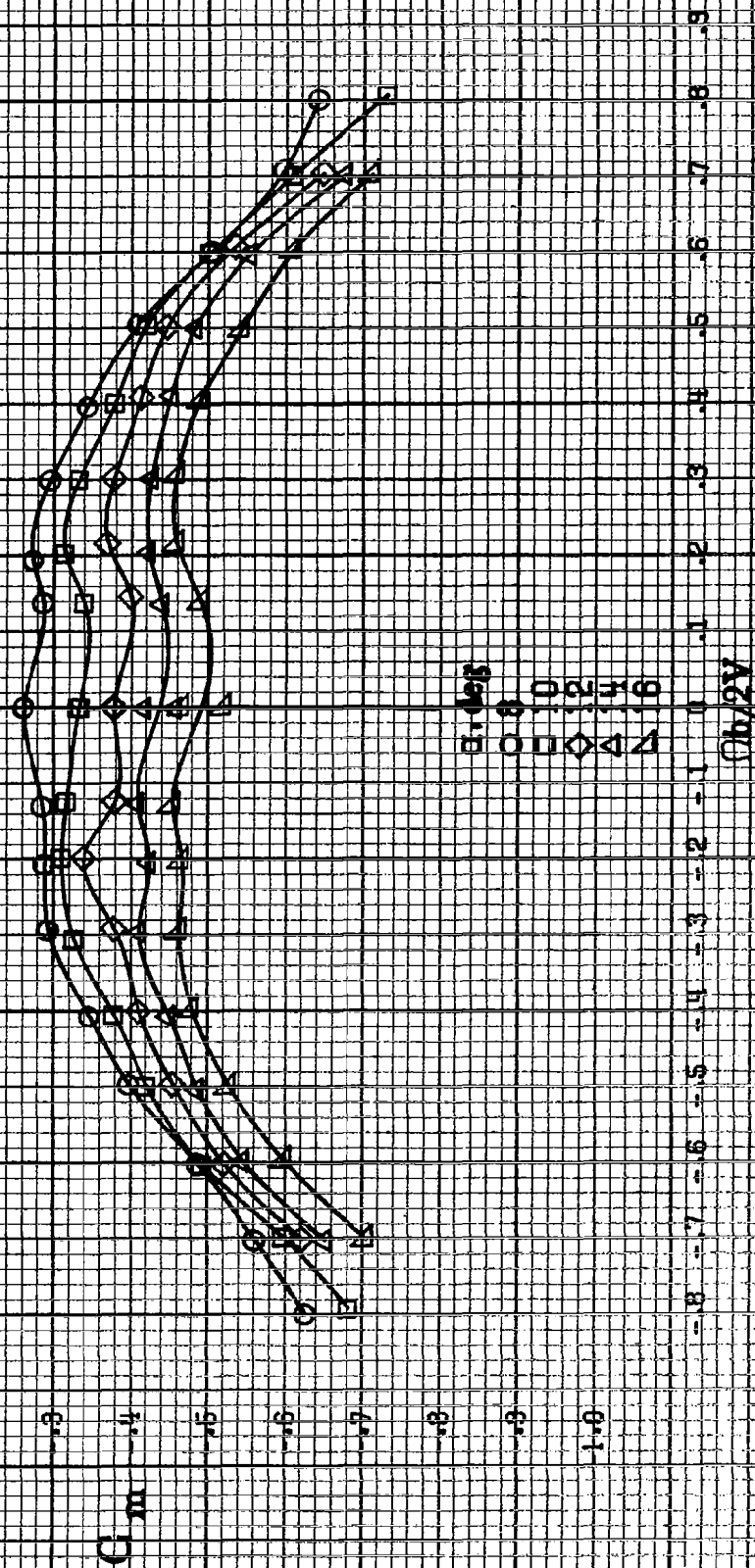
(c)  $\mu = 80$  to  $60^\circ$ ,  $SR = 0$ .  
Figure A38-Continued.



(d)  $\alpha = 55$  to  $90$  deg,  $SR = 0$ .  
Figure A38.-Continued.



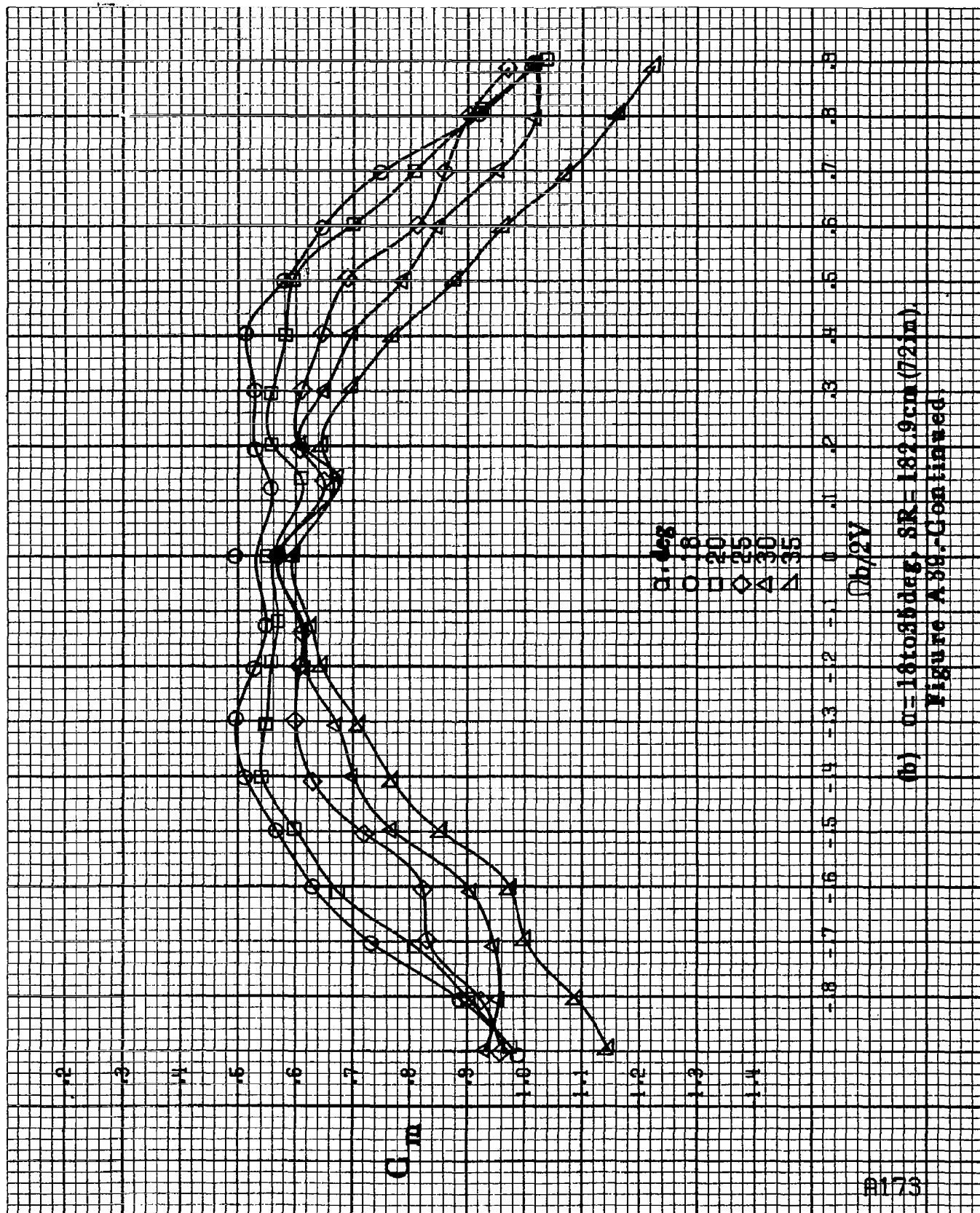
A1172



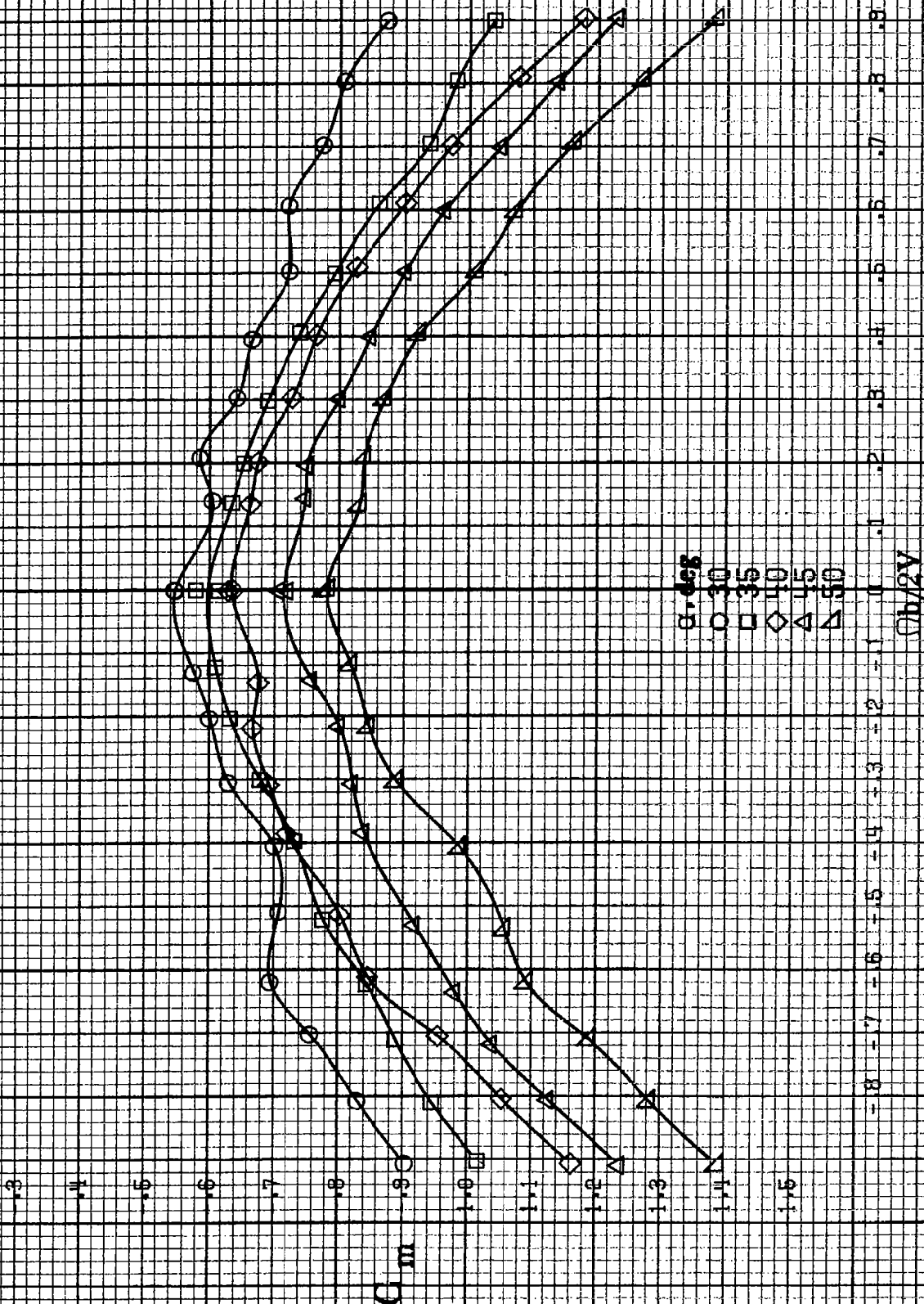
(a)  $\alpha = 8$  to  $16$  deg,  $SR = 182.9$  cm (72 in.).

Figure A39. Effect of rotation rate and angle of attack on pitching-moment coefficient for full-spin LL wing droop with large nose radius.  $\delta_s = 0^\circ$ ,  $\delta_r = 0^\circ$ ,  $\beta = 0^\circ$ .

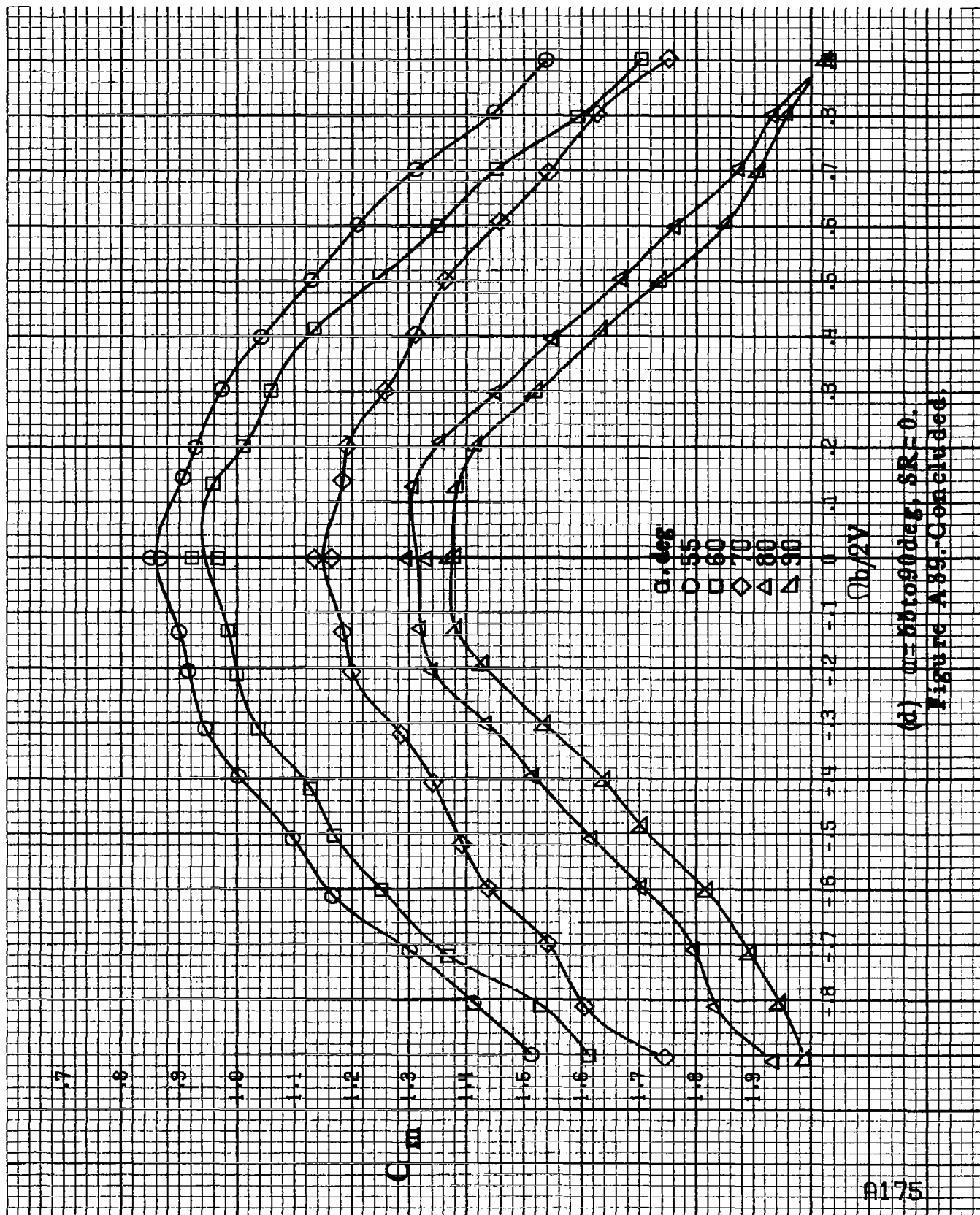




(b)  $\mu = 18$  to  $55$  deg;  $SR = 182.9$  cm (72 in).  
Figure A-89-Continued



(c)  $\theta = 30$  to  $50$  deg,  $SR = 0$ .  
Figure A89. Continued.



(d)  $\alpha=80^\circ$  to  $90^\circ$ ,  $SR=0$ .  
Figure A89. Concluded.

B1176

$\alpha, \text{deg}$   
 8  
 10  
 12  
 14  
 16

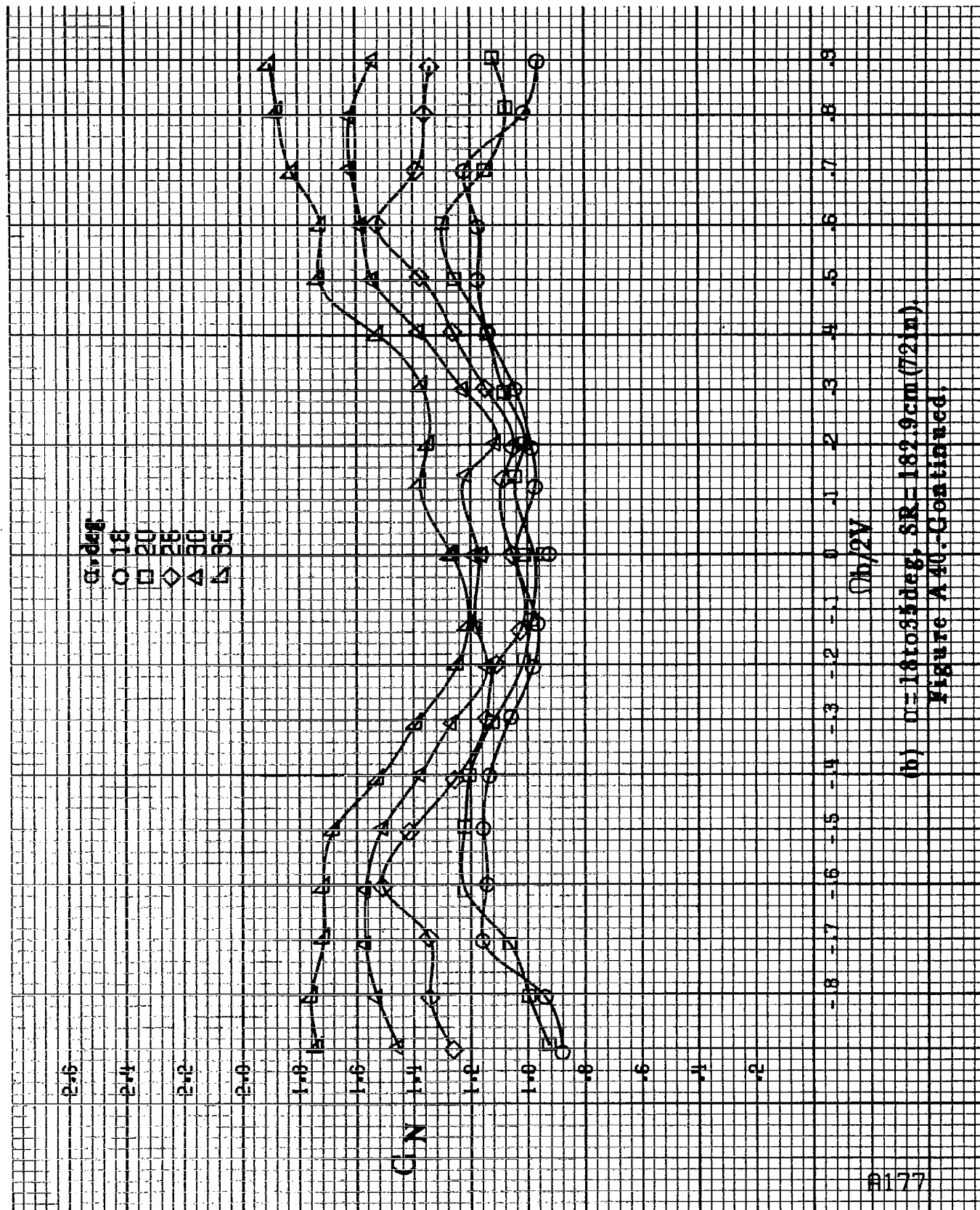
$C_N$

-1.8 -1.7 -1.6 -1.5 -1.4 -1.3 -1.2 -1.1 -1.0 -0.9 -0.8 -0.7 -0.6 -0.5 -0.4 -0.3 -0.2 -0.1 0 .1 .2 .3 .4 .5 .6 .7 .8 .9

$(b/2V)$

(a)  $\alpha = 8$  to  $16 \text{ deg}$ ,  $SR = 1.82.9 \text{ cm}$  (72 in).

Figure A40. Effect of rotation rate and angle of attack on normal-force coefficient for full-span LE wing droop with large nose radius.  $\delta_e = 10^\circ$ .  $\beta = 10^\circ$ .



(b)  $\alpha = 18 \text{ to } 35 \text{ deg}$ ,  $SR = 182.9 \text{ cm (72 in)}$   
 Figure A40.-Continued.

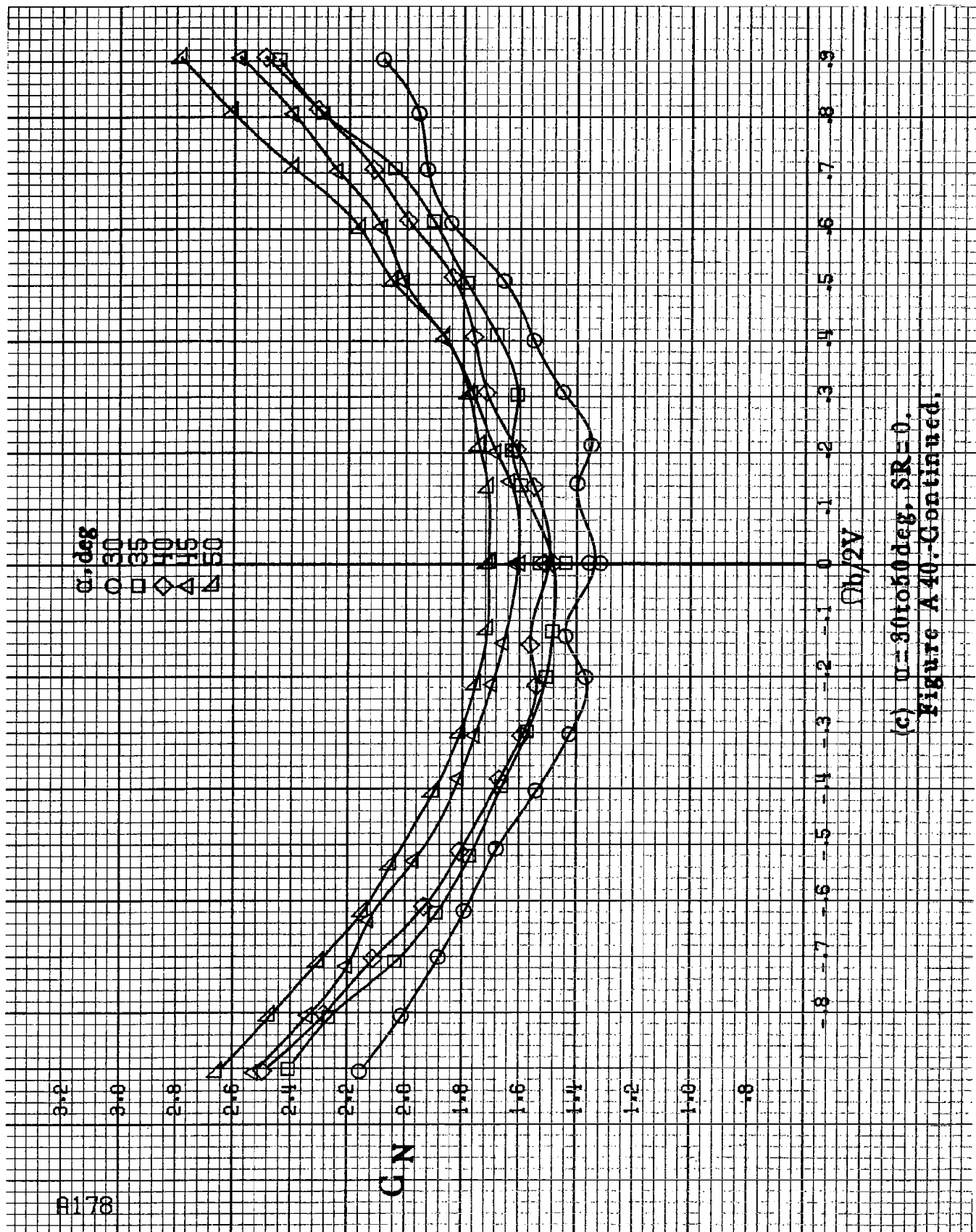
A178

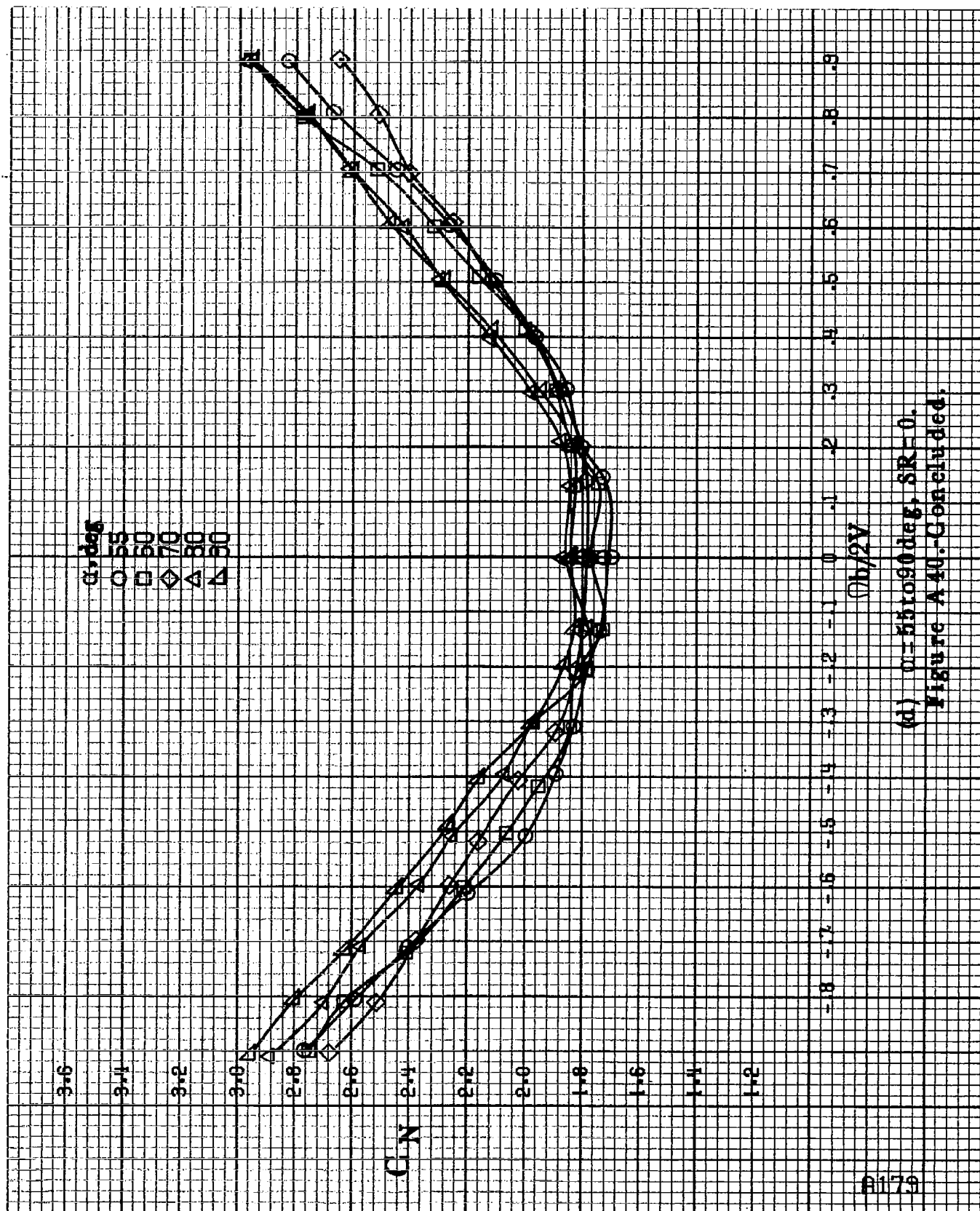
$\alpha, \text{deg}$   
 ○ 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▽ 50

CN

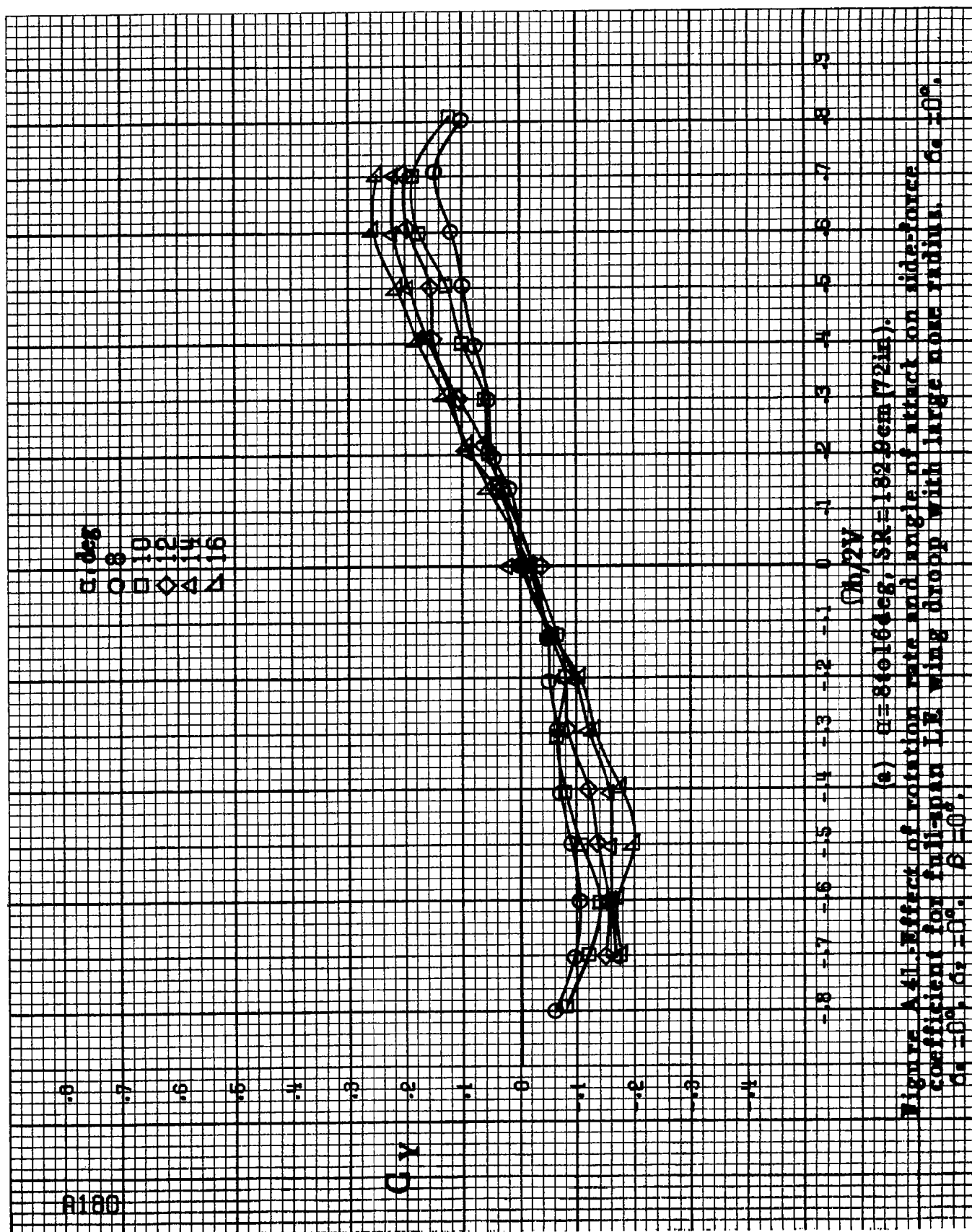
$\Omega_b/2V$

(c)  $\alpha = 30 \text{ to } 50 \text{ deg}$ ,  $SR = 0$ .  
 Figure A40-Continued.

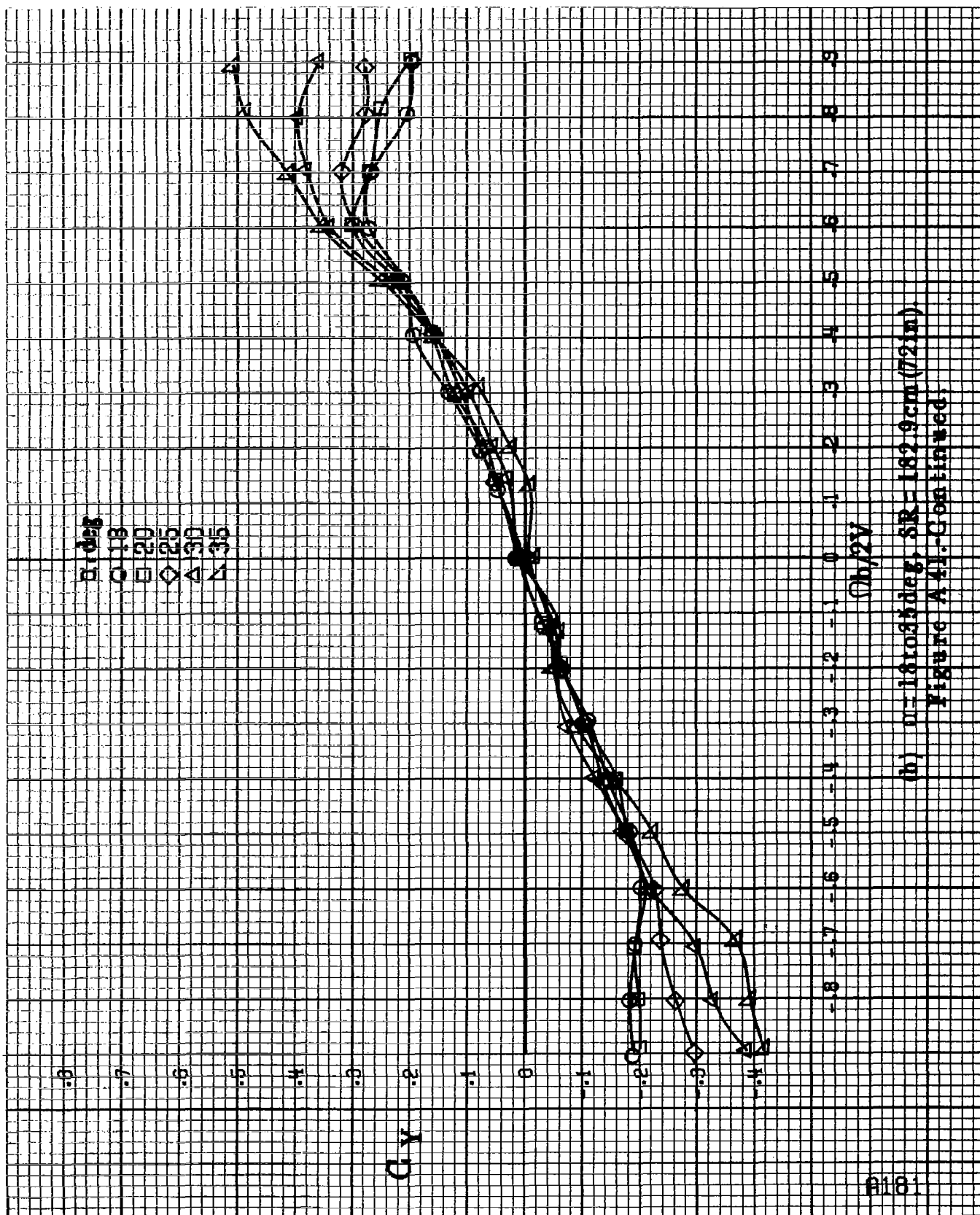




(d)  $\alpha = 55$  to  $90$  deg,  $SR = 0$ .  
Figure A 40.-Continued.







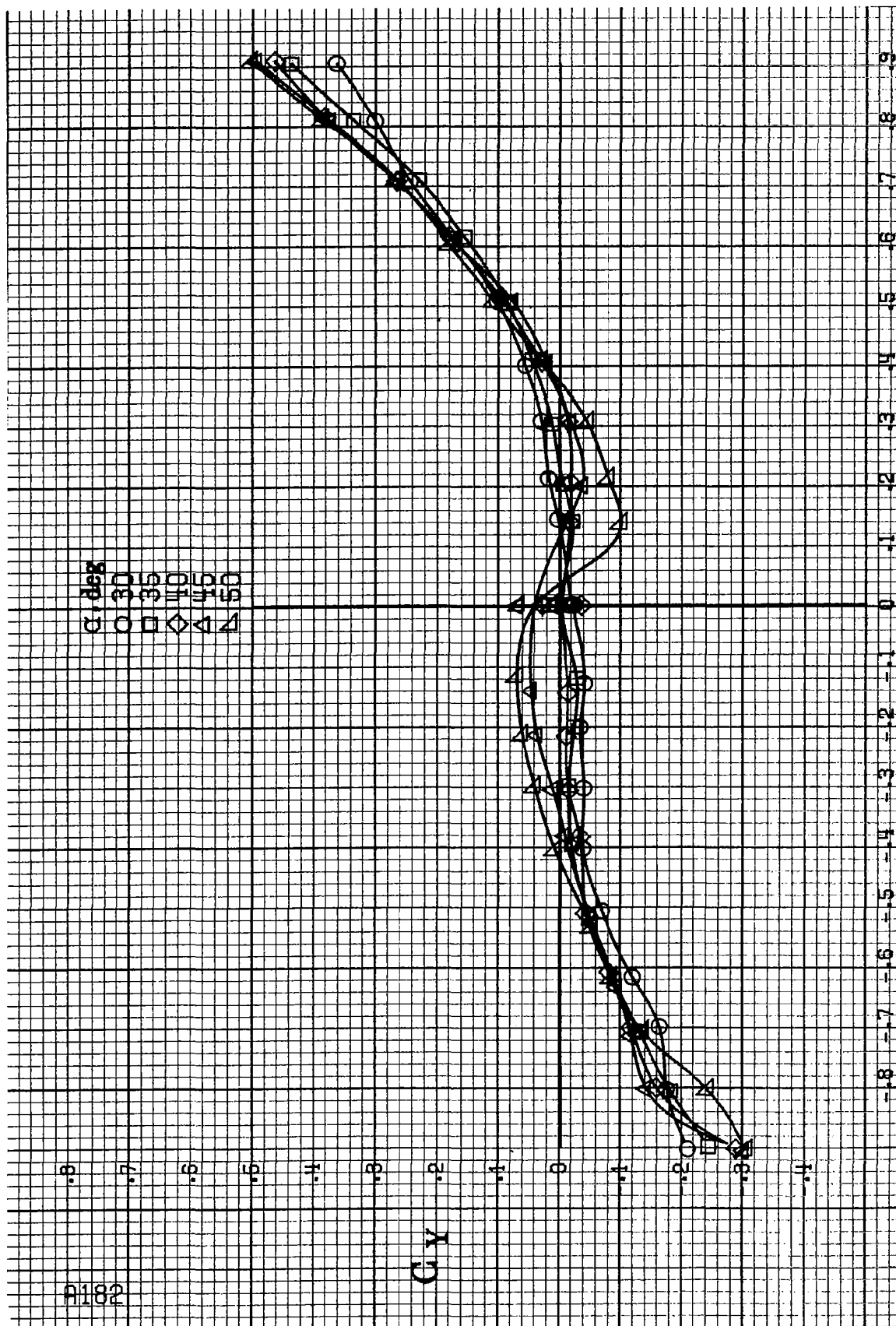
(b)  $\theta = 18$  to  $35^\circ$ ,  $SR = 182.9 \text{ cm (72 in.)}$   
Figure A41--Continued.

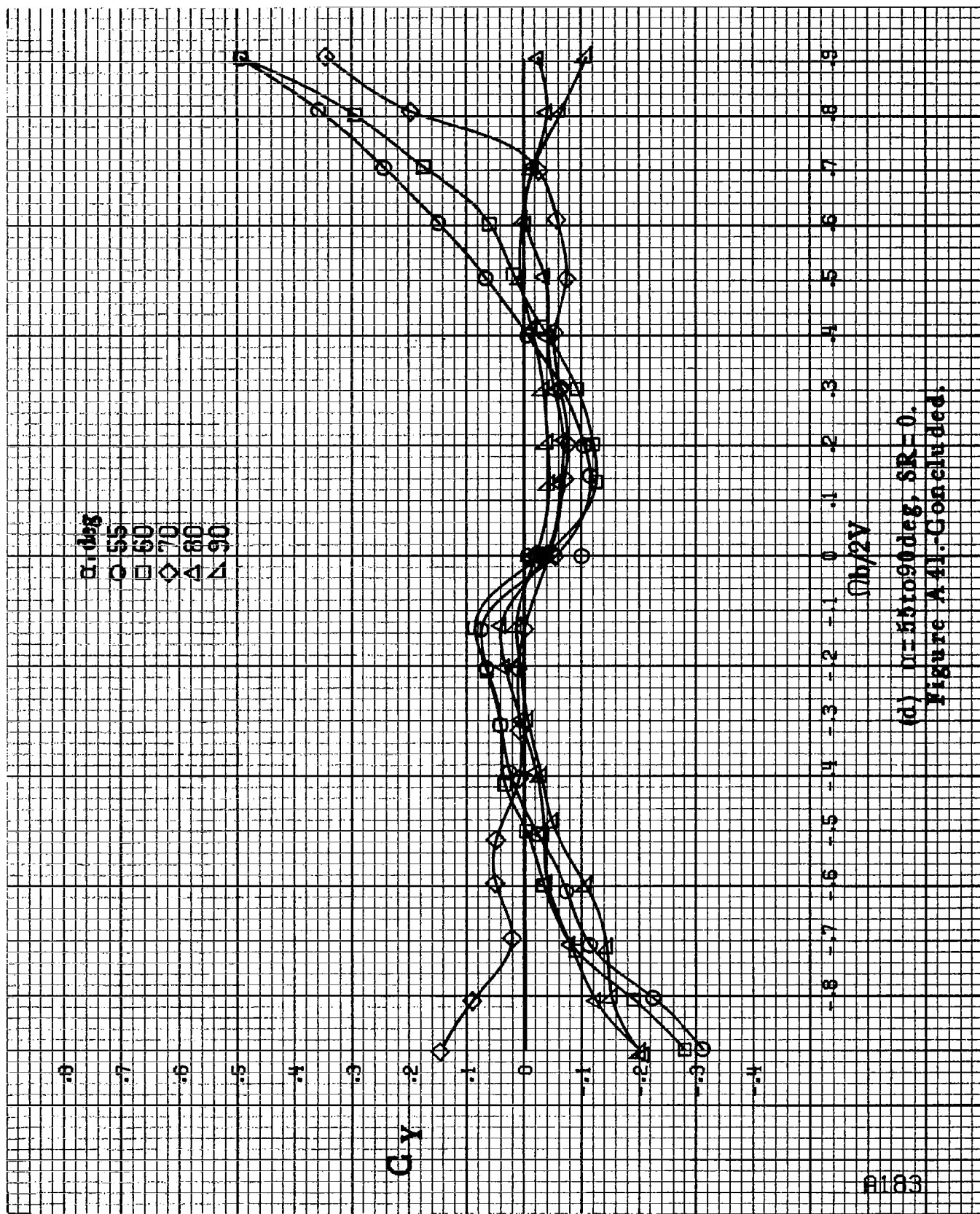
$\alpha$ , deg

○ 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▽ 50

 $C_Y$  $\alpha_b/2V$ 

(c)  $U=30$  to  $50$  deg,  $SR=0$ .  
 Figure A41-Continued.





(d)  $n=55$  to  $90$  deg,  $SR=0$ .  
Figure A41.-Concluded.

$\alpha = 0^\circ$   
 $\alpha = 10^\circ$   
 $\alpha = 20^\circ$   
 $\alpha = 30^\circ$   
 $\alpha = 40^\circ$   
 $\alpha = 50^\circ$

$C_A$

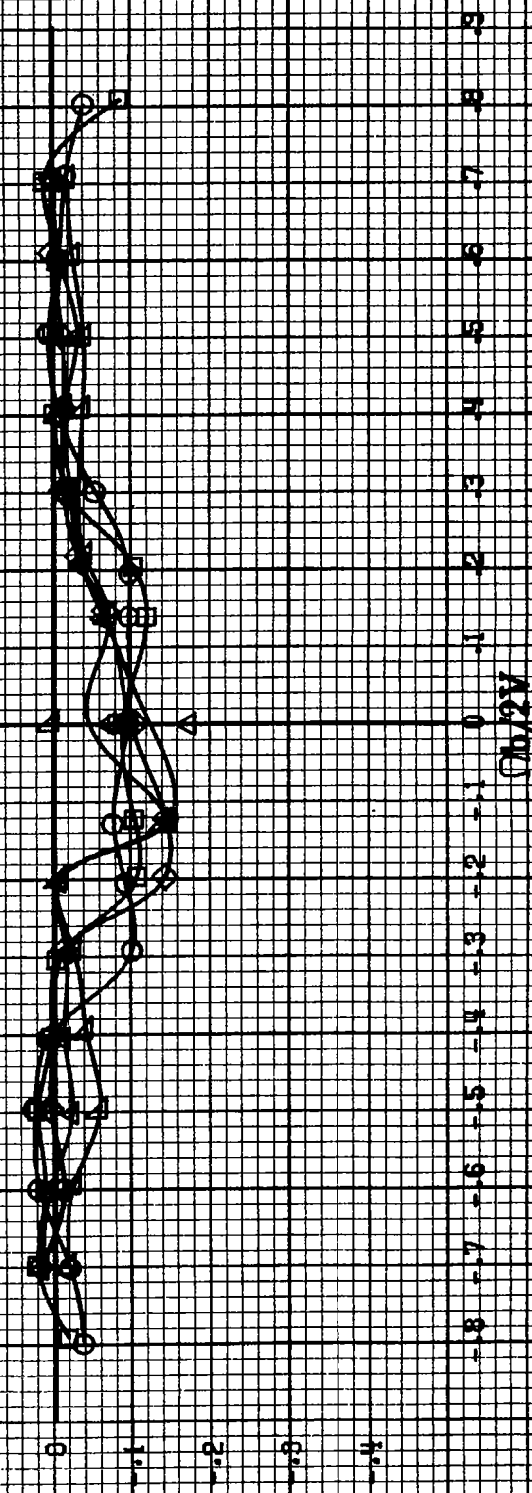
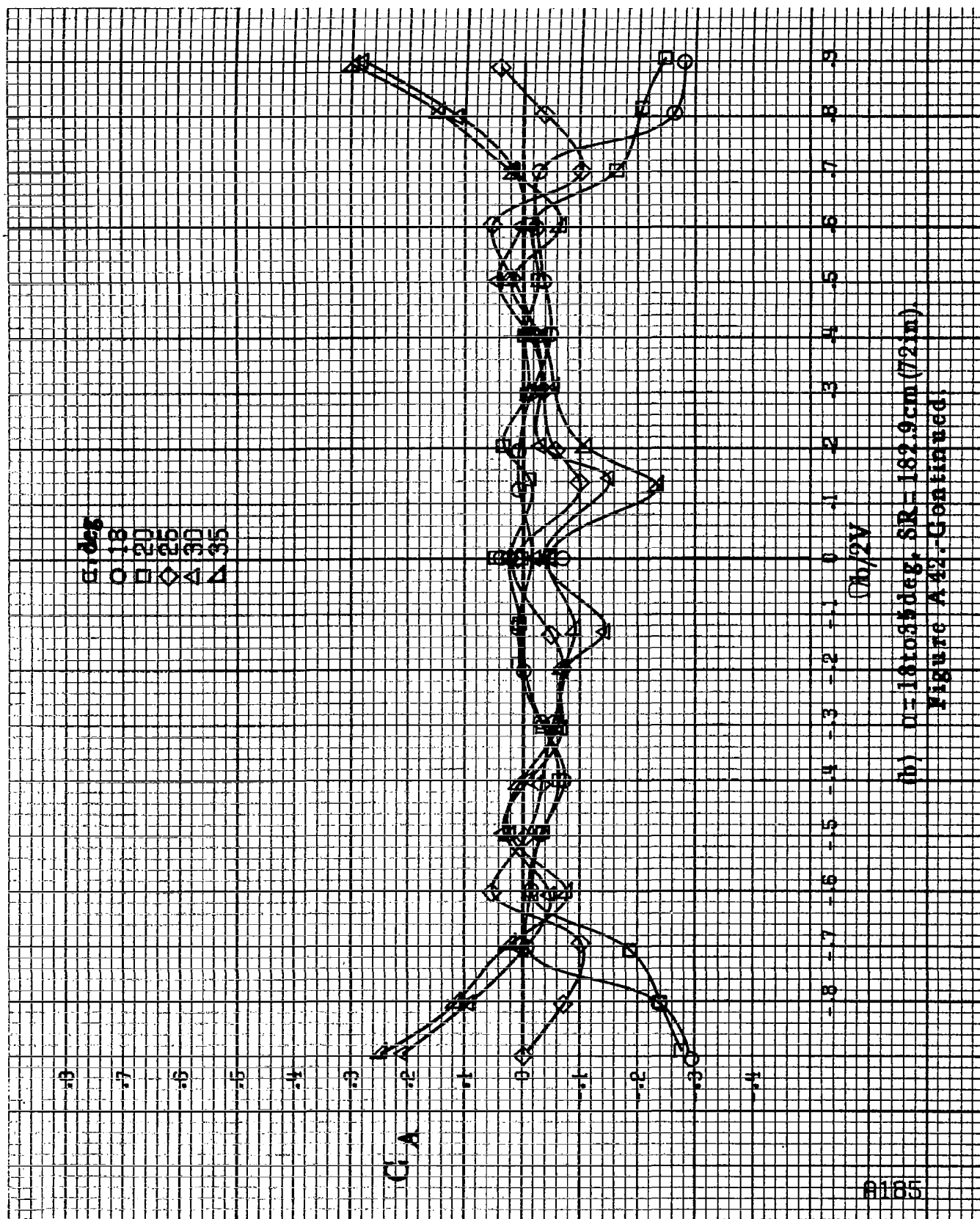
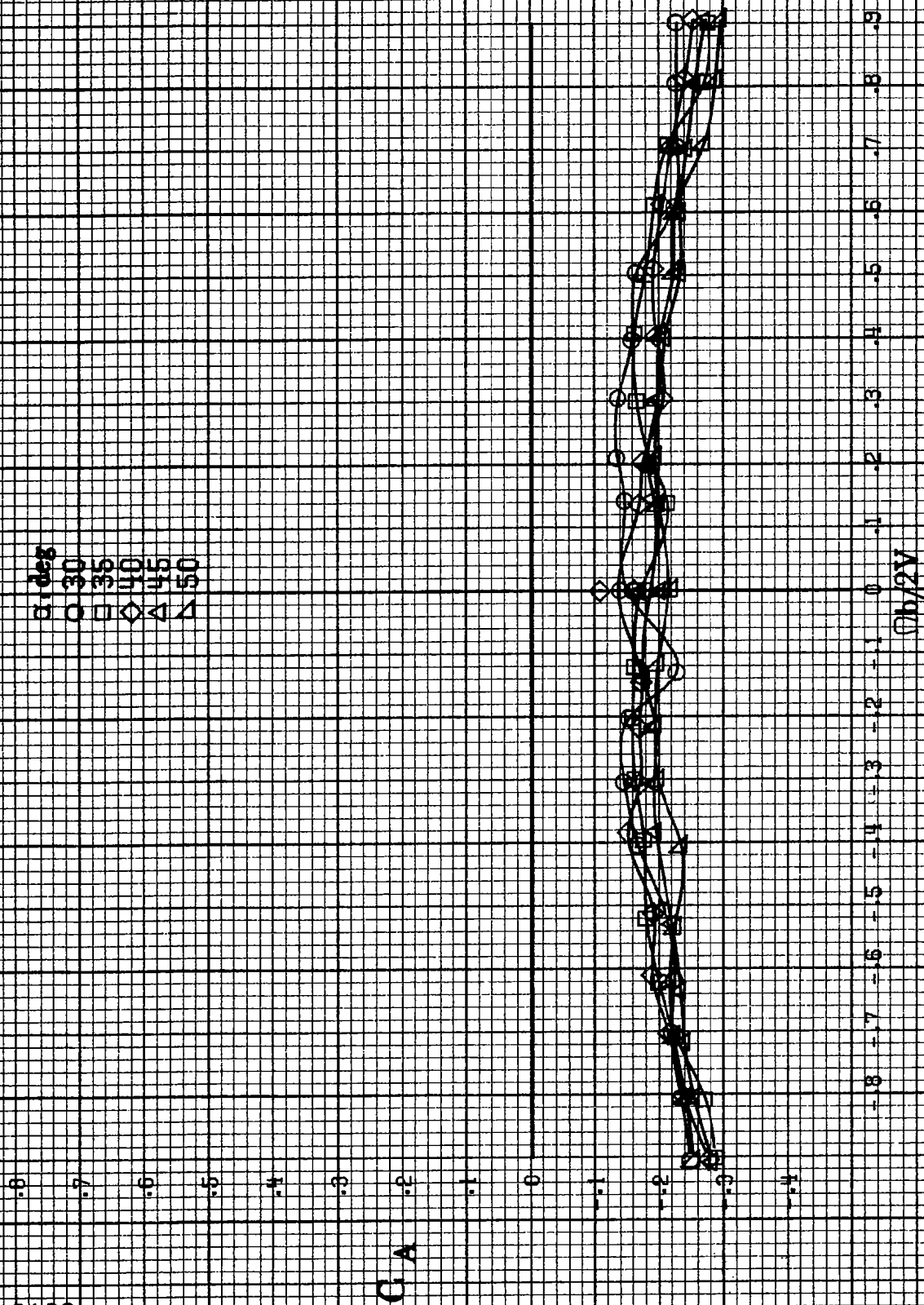


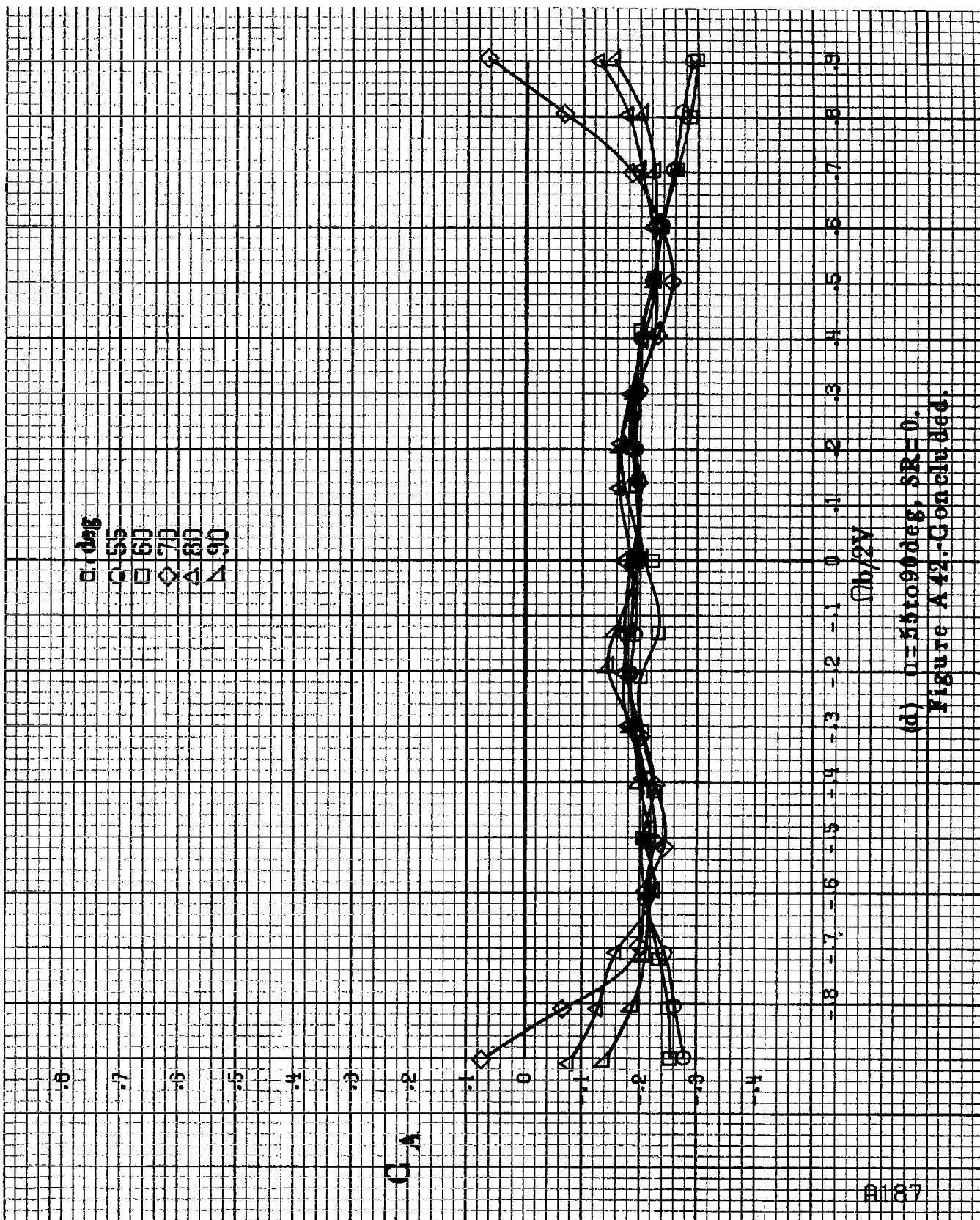
Figure A42. Effect of rotation rate and angle of attack on axial force coefficient for full-span LK wing droop with large nose radius.  $\alpha = 0^\circ$ ,  $\alpha = 10^\circ$ ,  $\alpha = 20^\circ$ ,  $\alpha = 30^\circ$ ,  $\alpha = 40^\circ$ ,  $\alpha = 50^\circ$ .  
 (a)  $\alpha = 84.16 \text{ deg}$ ,  $SR = 132.9 \text{ cm} (72 \text{ in})$ .



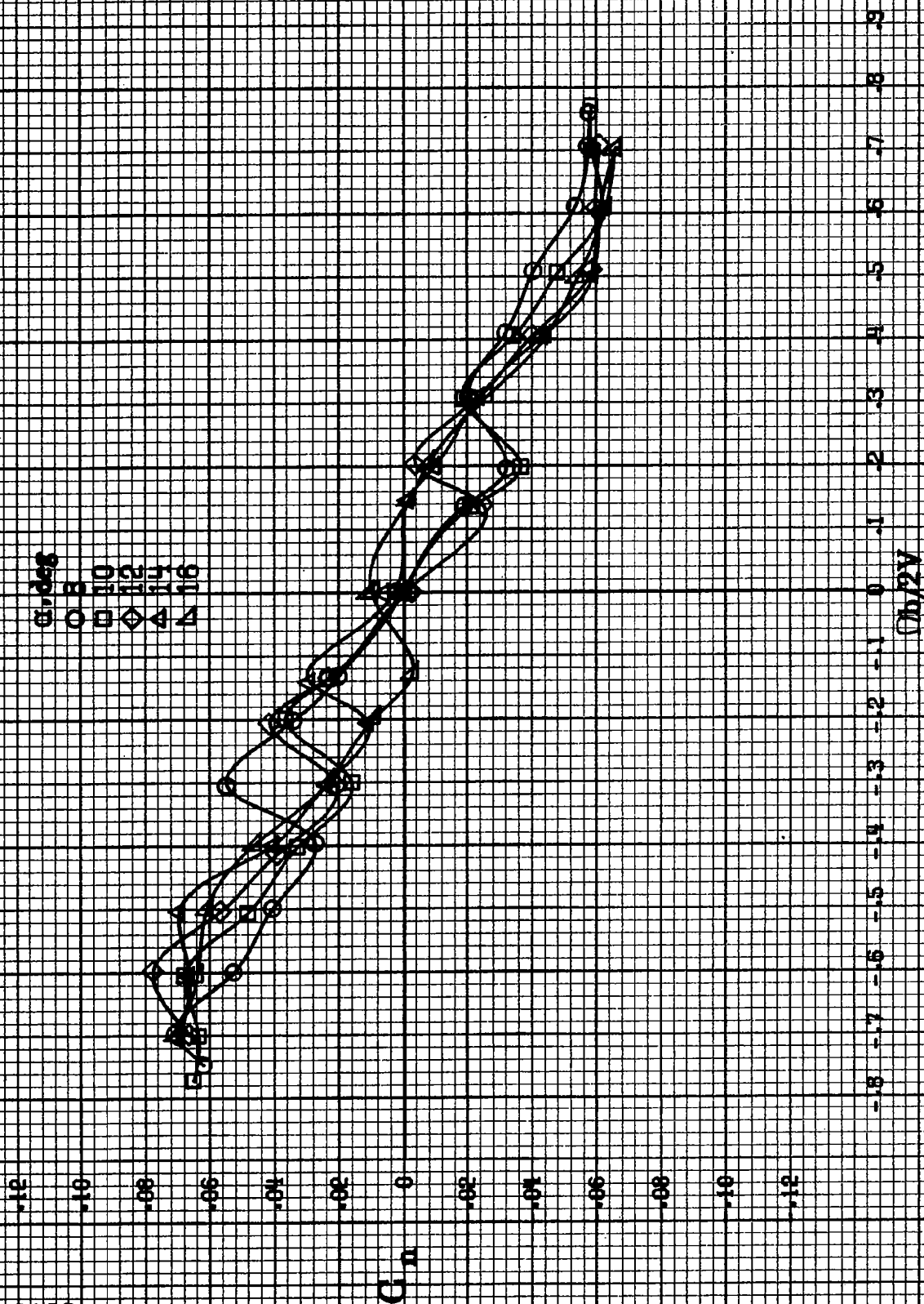
(b)  $\mu = 16.034 \text{ deg}$ , SR = 182.9 cm (72 in).  
Figure A42-Continued.



(c)  $\alpha = 30$  to  $50$  deg,  $SR = 0$ .  
Figure A 42.-Continued.



(d)  $\alpha = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A42.-Concluded.



(a)  $\alpha = 8$  to  $16^\circ$ ,  $SR = 182.9$  cm (72 in.).

Figure A43.-Effect of rotation rate and angle of attack on yawing moment coefficient for full-span L3 wing droop with large nose radius and sharp-edged fuselage bottom.  $\delta_s = 0^\circ$ ;  $\delta_a = 0^\circ$ ;  $\delta_r = 0^\circ$ ;  $\beta = 0^\circ$ .



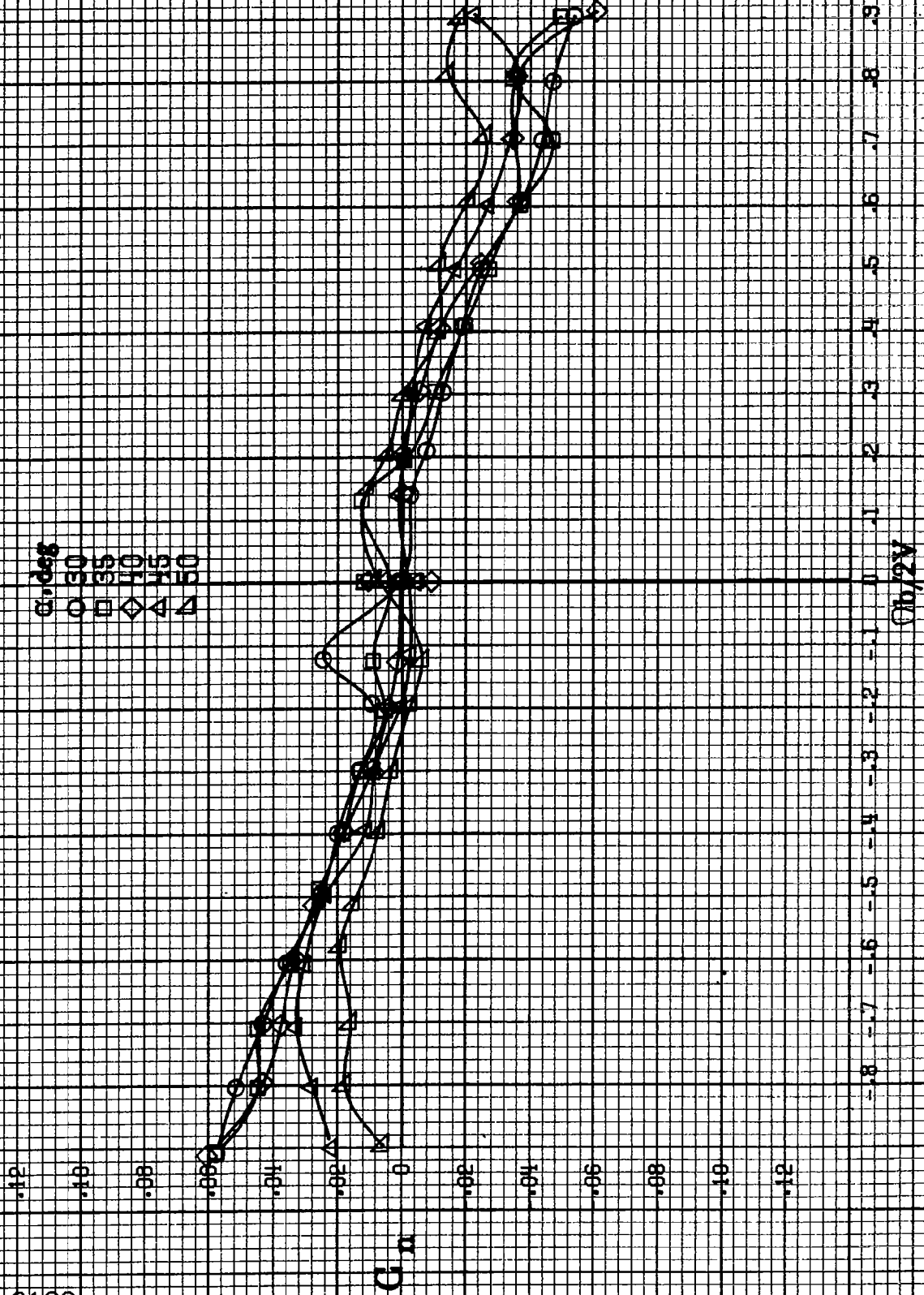
$\alpha$ , deg  
 ○ 18  
 □ 20  
 ◇ 25  
 △ 30  
 ▲ 35

$C_n$

$Ob/2V$

(b)  $\alpha = 18$  to  $35$  deg,  $SR = 182.9$  cm (72 in)  
 Figure A43-Continued

$\theta$ , deg  
 30  
 35  
 40  
 45  
 50



(c)  $\alpha = 30$  to  $50$  deg,  $SR = 0$ .  
 Figure A48-Continued

$\alpha, \text{deg}$   
 ○ 55  
 □ 60  
 ◇ 70  
 △ 80  
 ▲ 90

.12

.10

.08

.06

.04

.02

0

-.02

-.04

-.06

-.08

-.10

-.12

$C_{1n}$

$Cb/2V$

.9

.8

.7

.6

.5

.4

.3

.2

.1

0

-.1

-.2

-.3

-.4

-.5

-.6

-.7

-.8

B191

(d)  $\alpha=55$  to  $90$  deg,  $SR=0$ .  
 Figure A48.-Concluded.

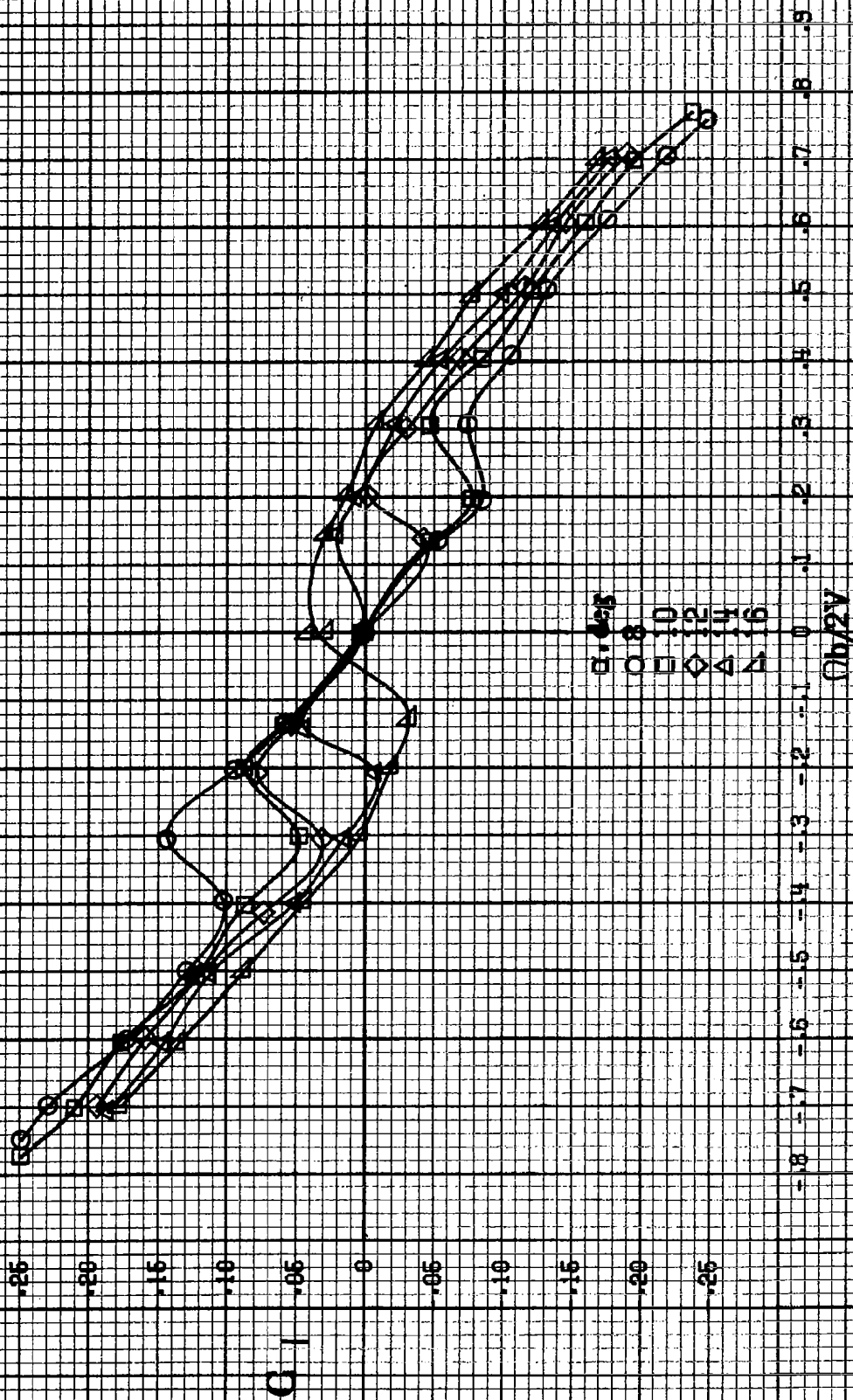
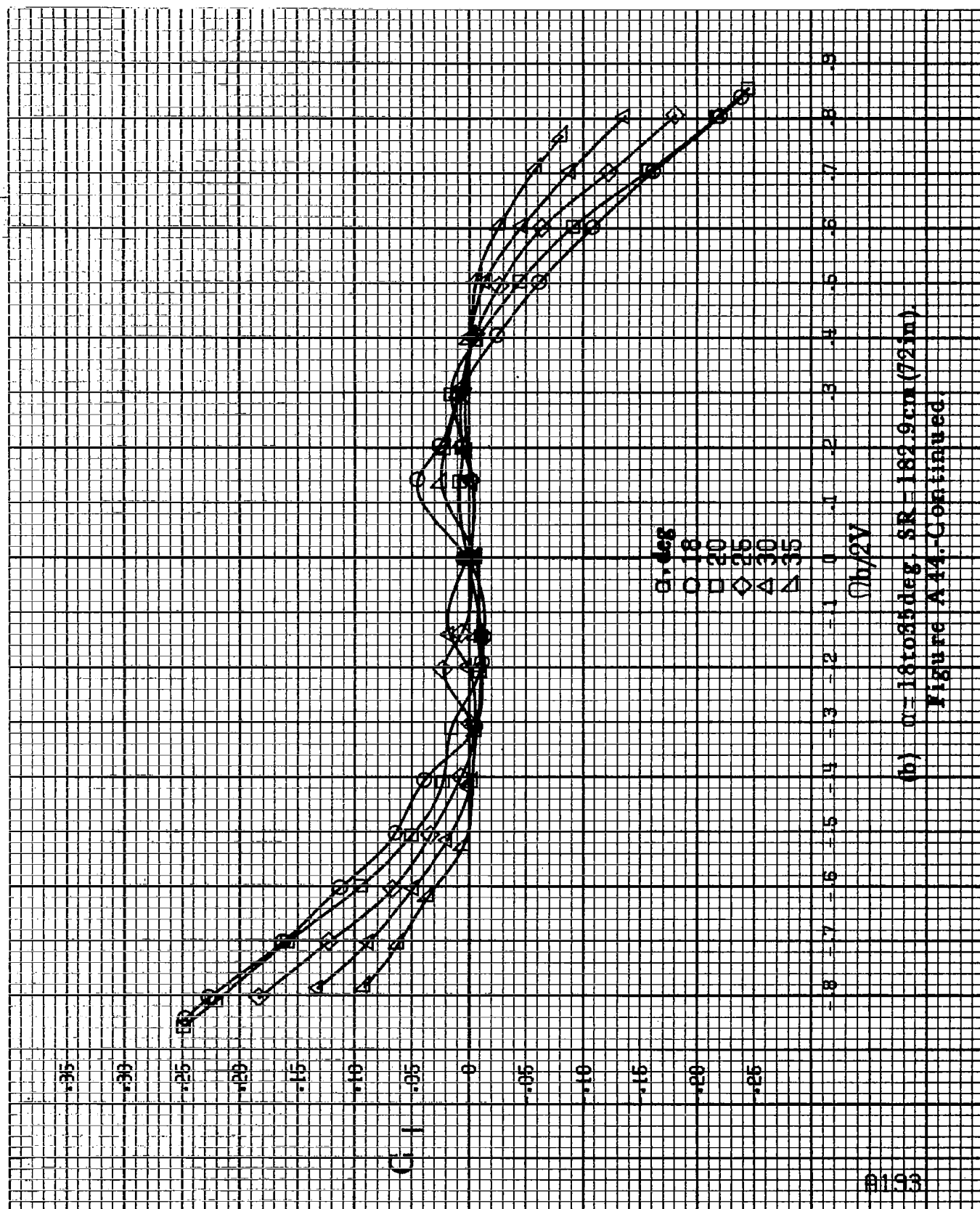


Figure A44. Effect of rotation rate and angle of attack on rolling-moment coefficient for full-span L.E. wing droop with large nose radius and sharp-edged fuselage bottom.  $\delta_1 = 0^\circ$ ,  $\delta_2 = 0^\circ$ ,  $\delta_3 = 0^\circ$ .  $\delta = 0^\circ$ .



(b)  $\alpha = 18$  to  $35^\circ$ ,  $SR = 182.9 \text{ cm (72 in.)}$ .  
Figure A14-Continued.

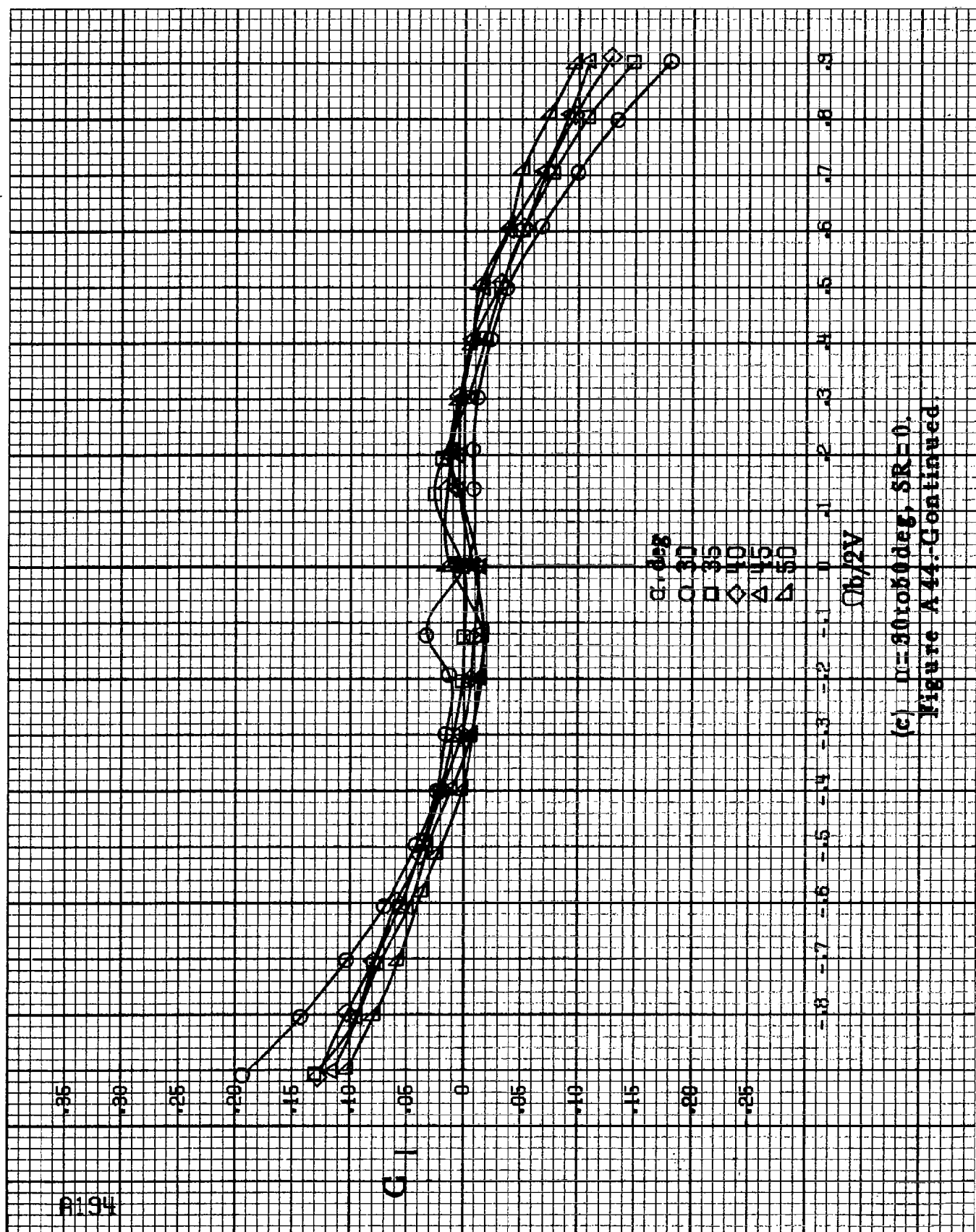
$C_1$

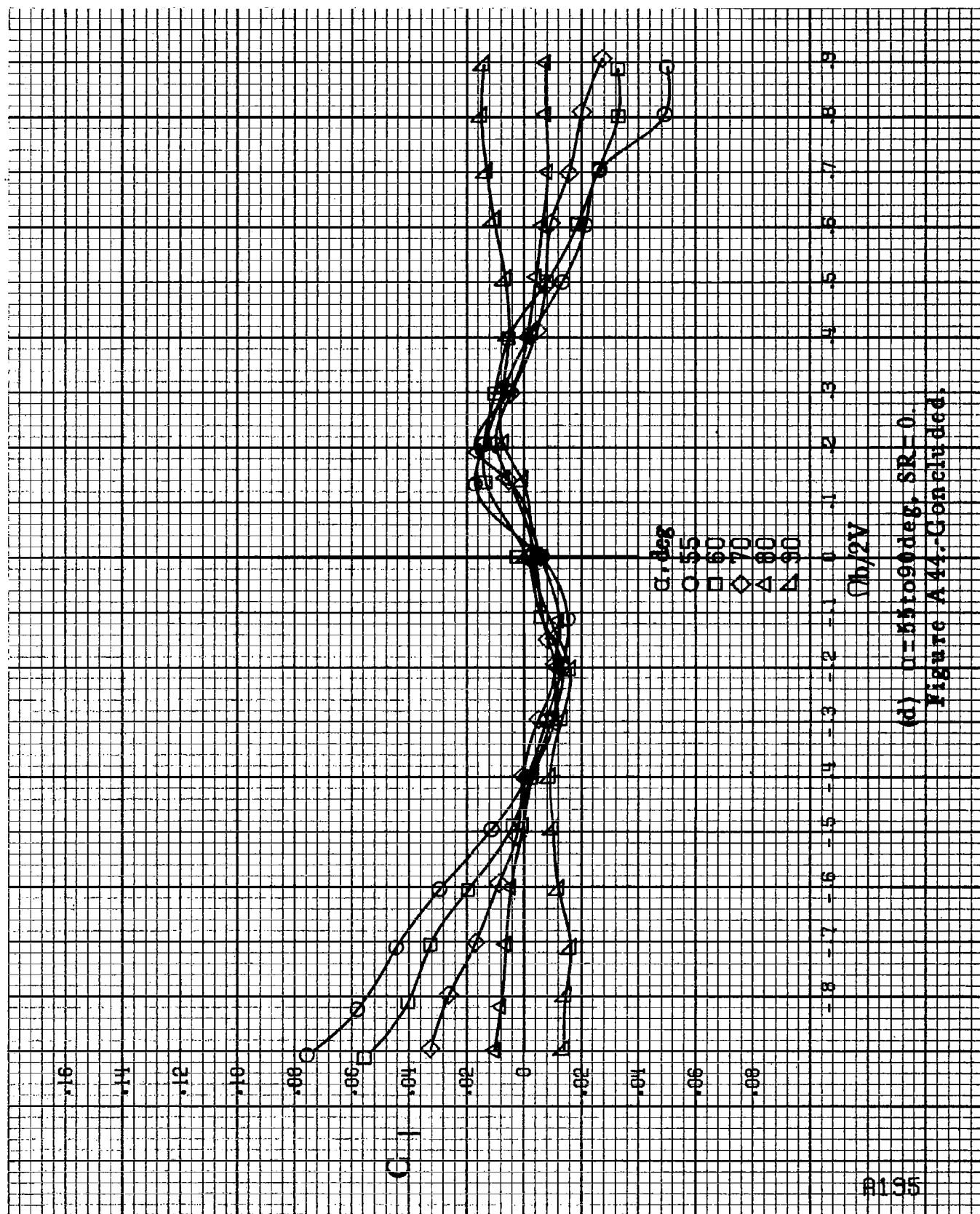
$\alpha, \text{deg}$

- $\circ$  30
- $\square$  35
- $\diamond$  40
- $\triangle$  45
- $\nabla$  50

$\Omega b/2V$

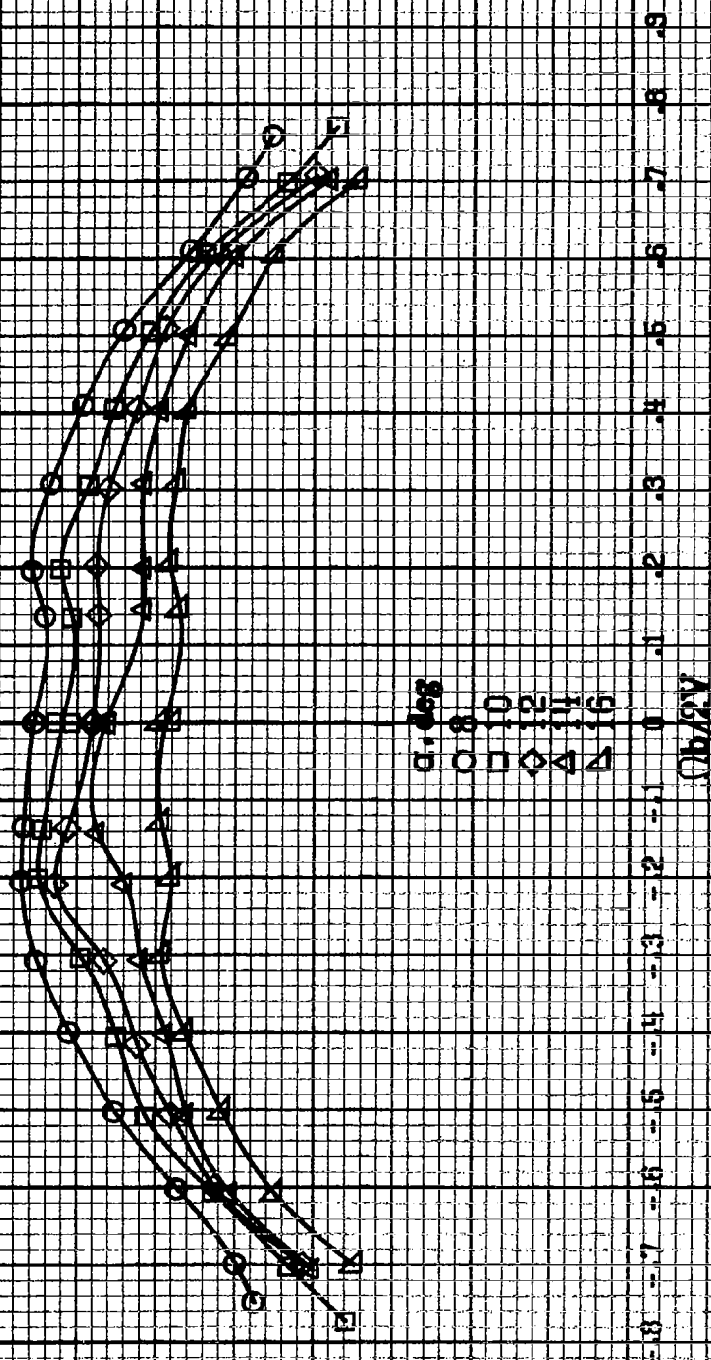
(c)  $\mu=30$  ro 60 deg,  $SR=0$ ,  
Figure A44-Continued.





(d) 0-55 to 90 deg, SR=0.  
Figure A 44.-Concluded.

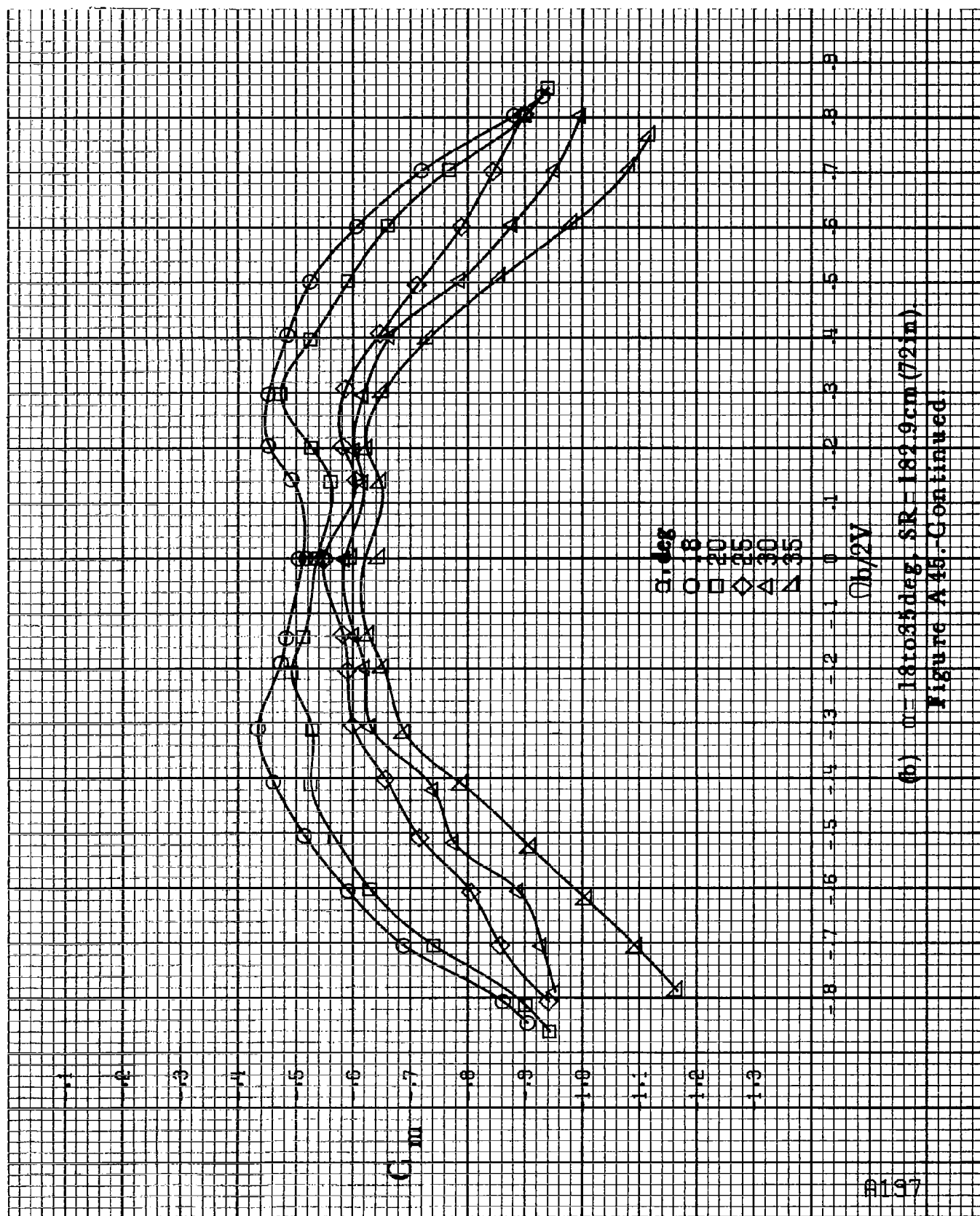
$C_m$



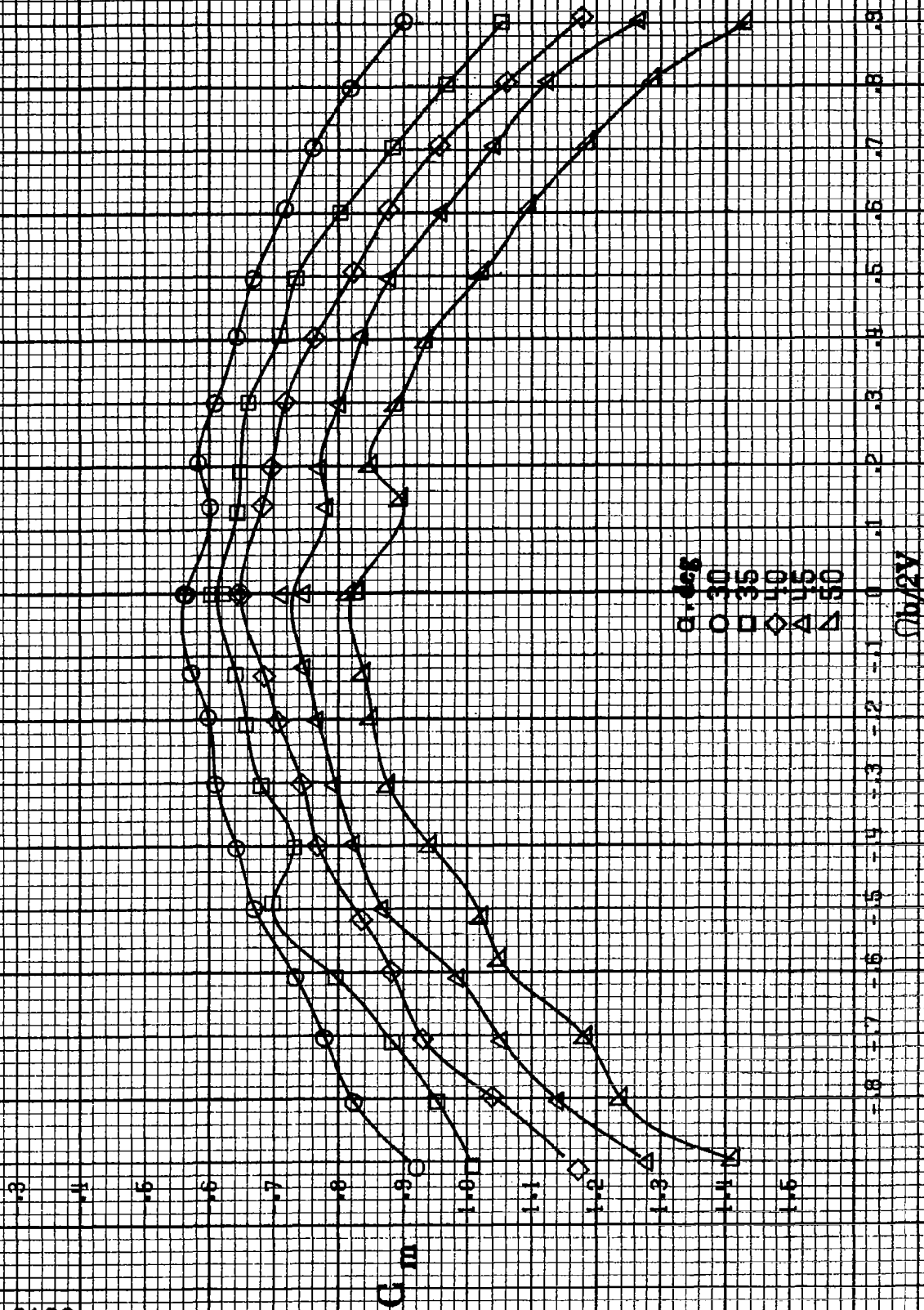
(a)  $\alpha = 8$  to  $16^\circ$ ,  $SR = 182.8$  cm (72 in.).

Figure A46. Effect of rotation rate and angle of attack on pitching-moment coefficient for full-spin LR wing droop with large nose radius and sharp-edged fuselage bottom.  $\delta_1 = 0^\circ$ ,  $\delta_2 = 0^\circ$ ,  $\delta_3 = 0^\circ$ ,  $\beta = 0^\circ$ .

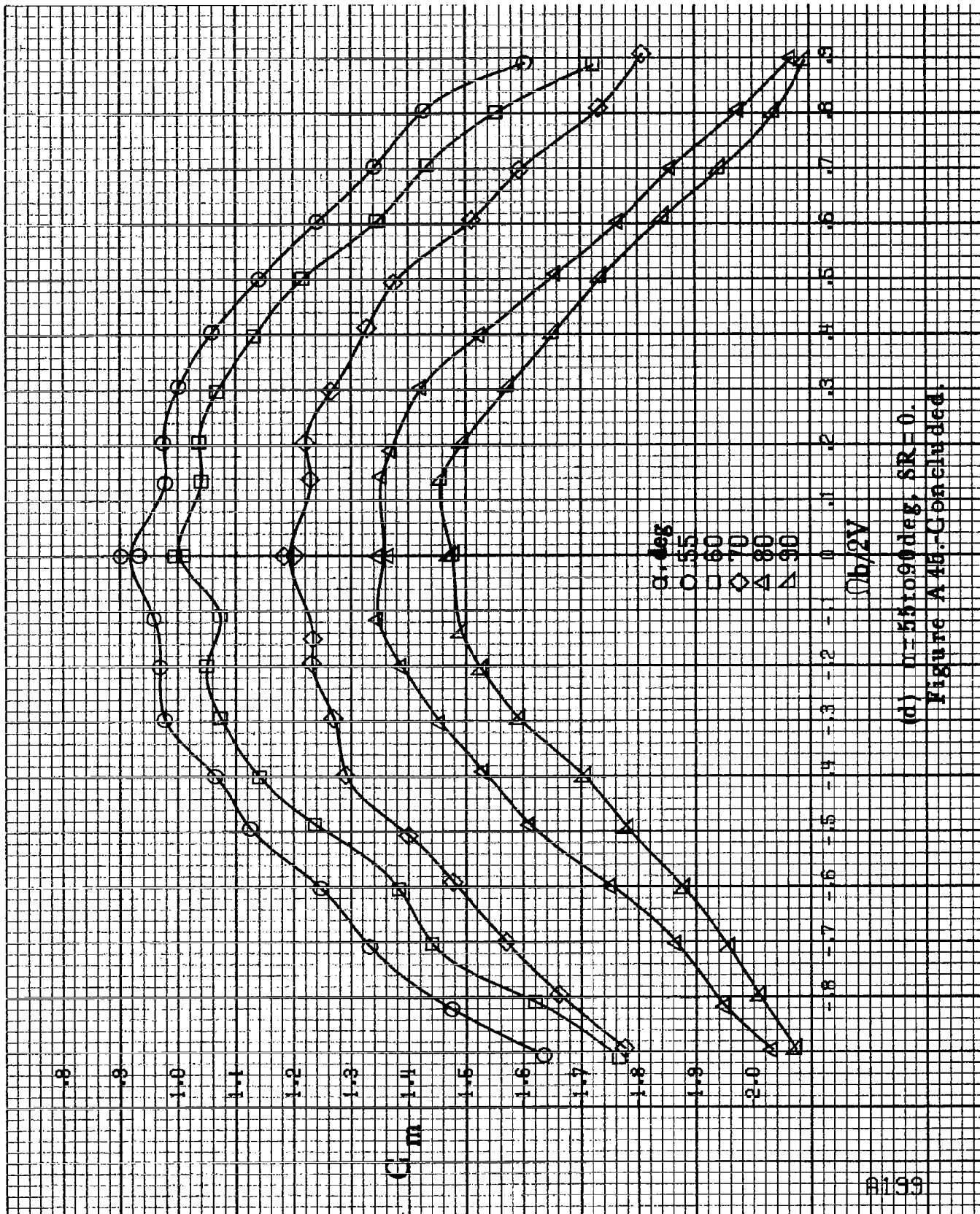




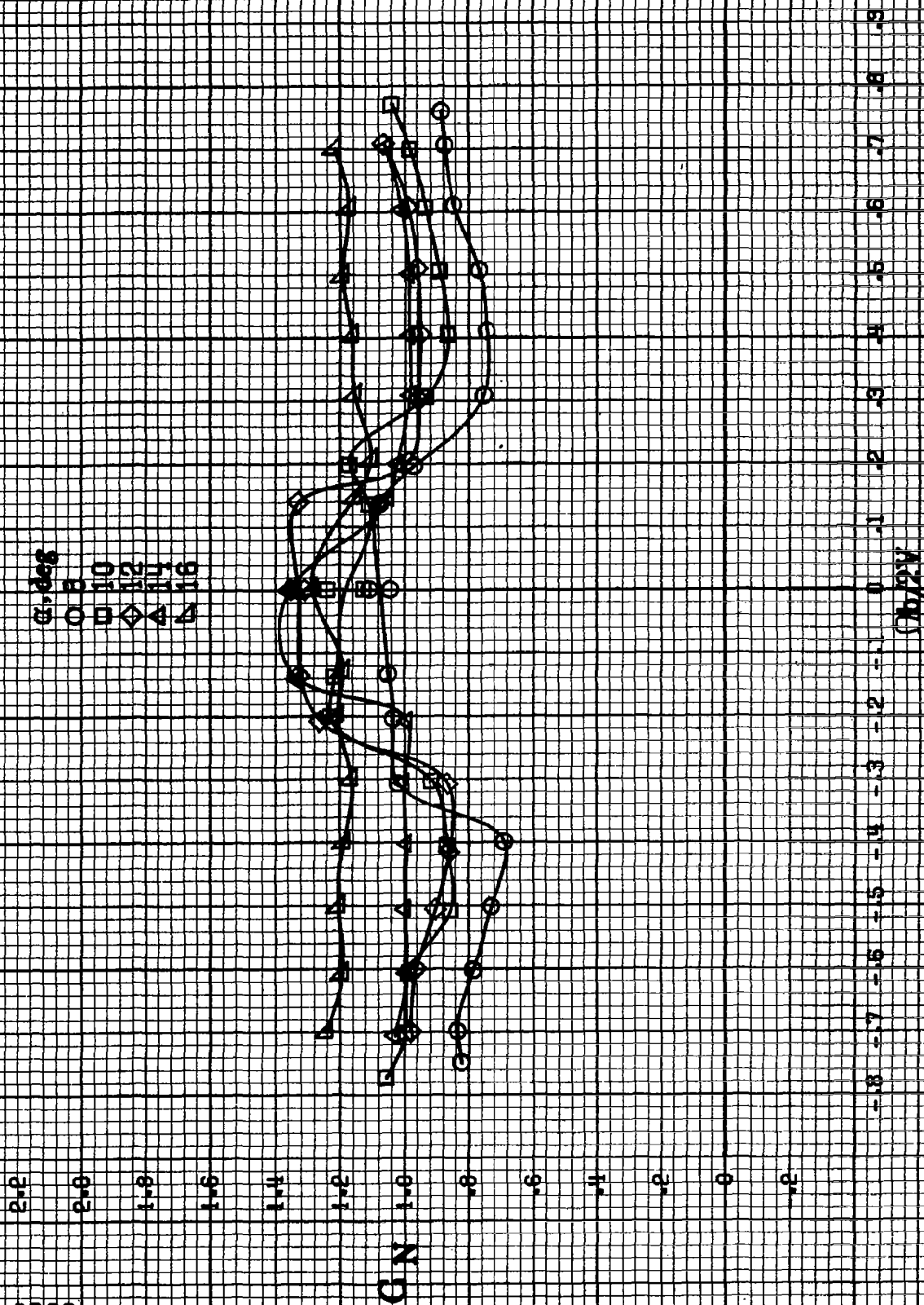
(b)  $\alpha = 18$  to  $35^\circ$ ,  $SR = 182.9 \text{ cm (72 in)}$   
 Figure A45-Continued.



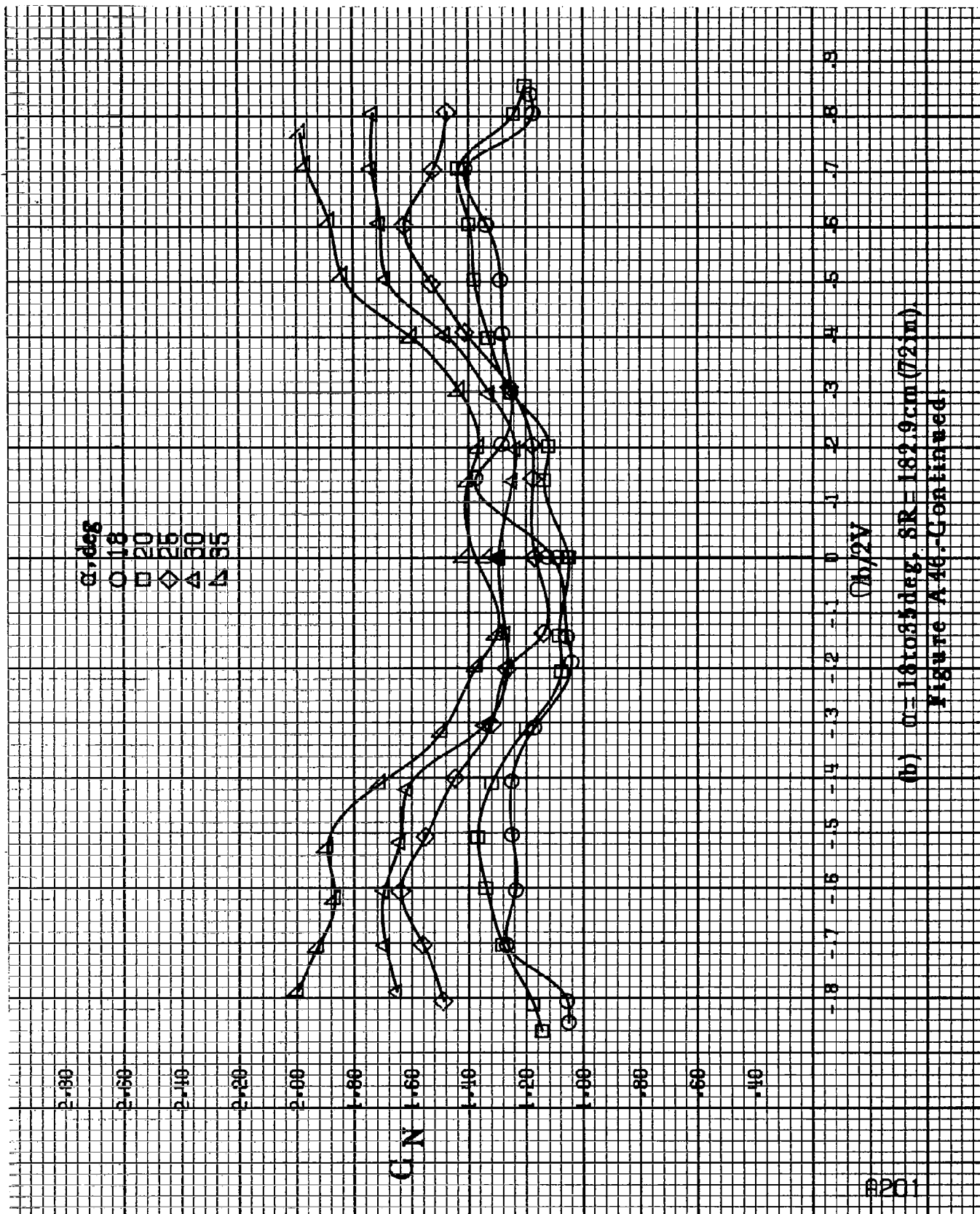
( $\alpha$ )  $m = 86$  to  $60$  deg,  $SR = 0$ .  
Figure A45: Continued



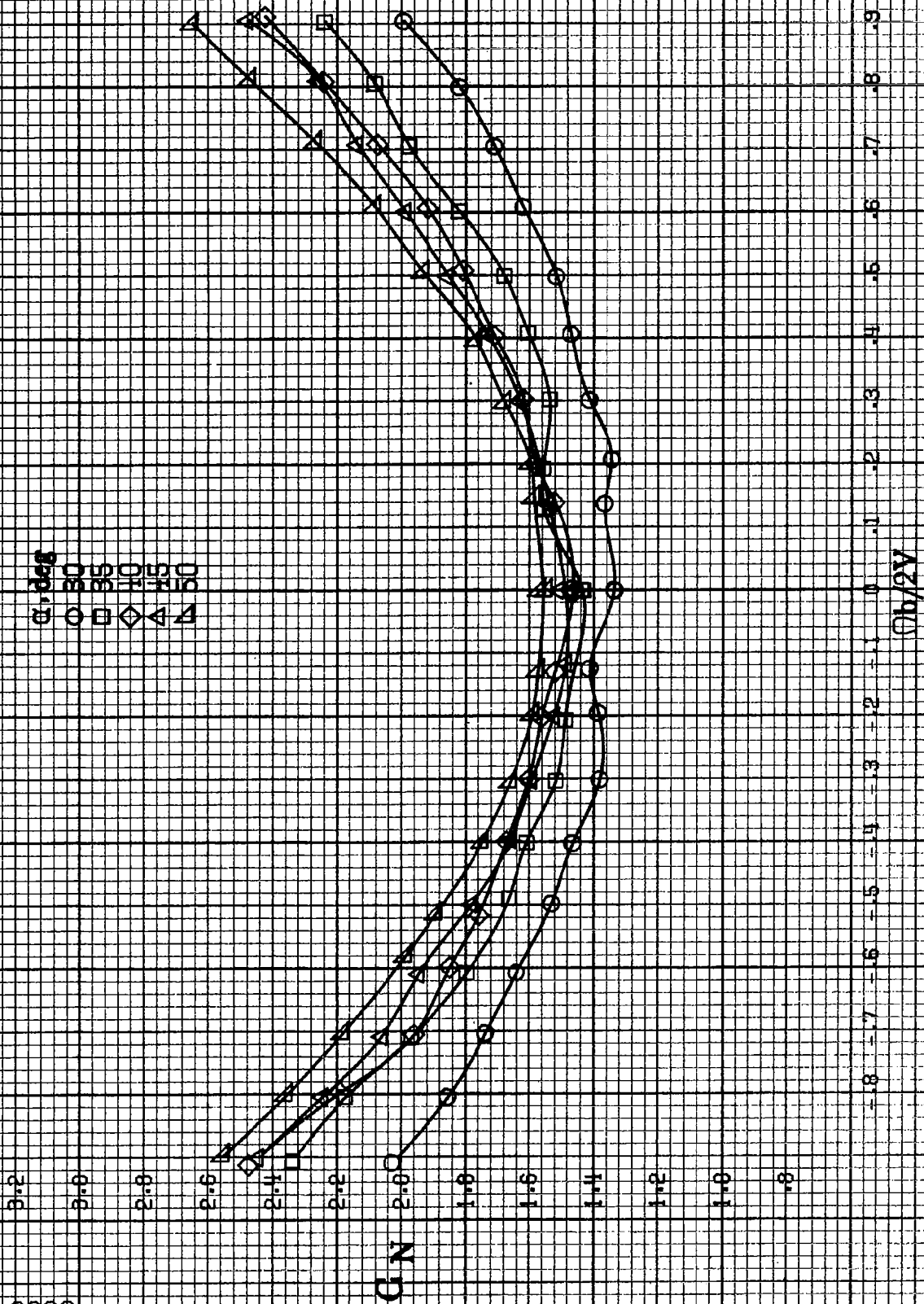
(d)  $\theta = 55$  to  $90$  deg,  $SR = 0$ .  
Figure A 46.-Concluded.



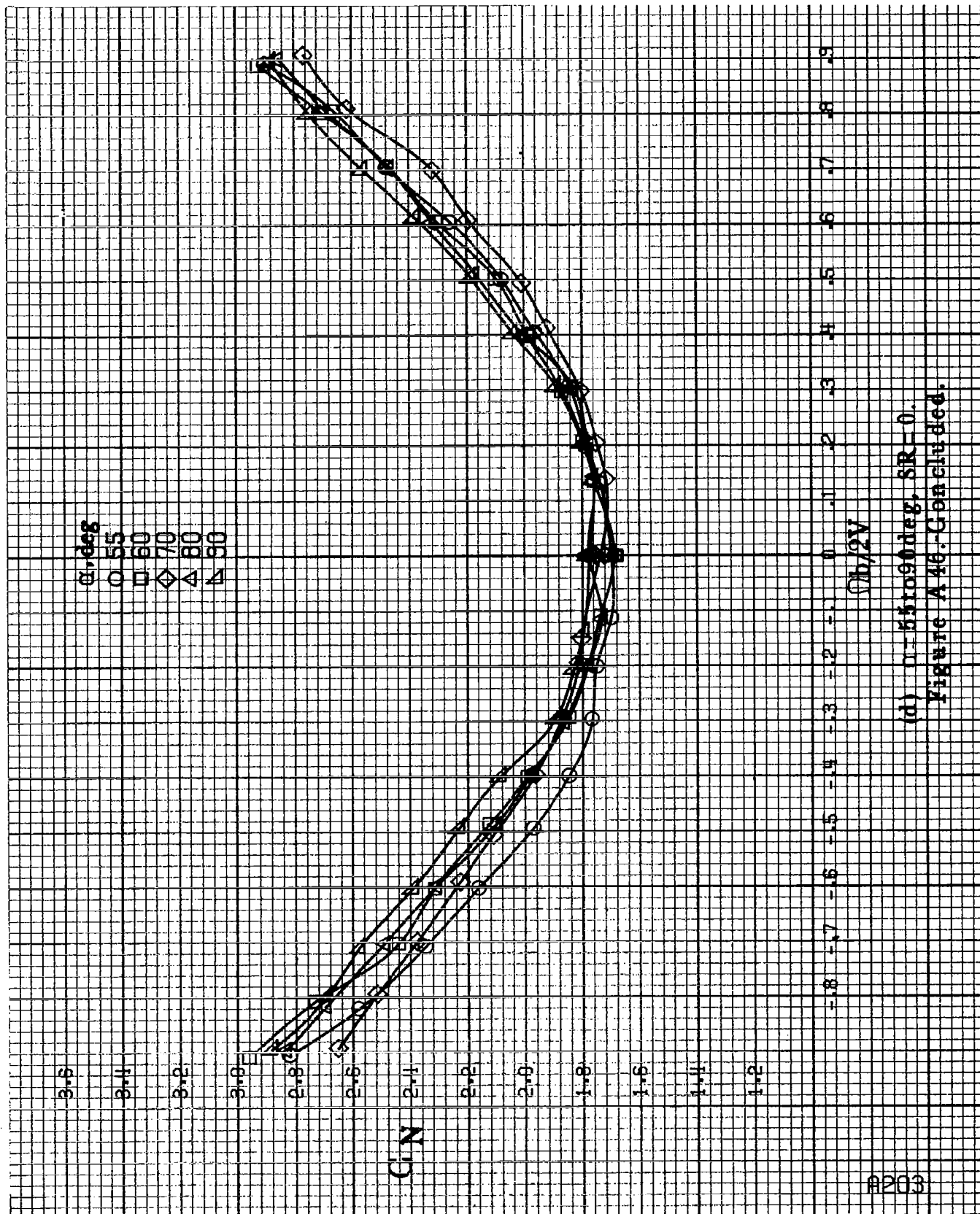
(a)  $\alpha = 84.0164 \text{ deg}$ ,  $SR = 182.8 \text{ cm (72 in.)}$ .  
 Figure A-48. Effect of rotation rate and angle of attack on normal force coefficient for full-span 1/2 wing droop with large nose radius and sharp-edged fairings bottom.  $\delta_a = 0^\circ$ ,  $\delta_s = 0^\circ$ ,  $\delta_r = 0^\circ$ ,  $\beta = 0^\circ$ .



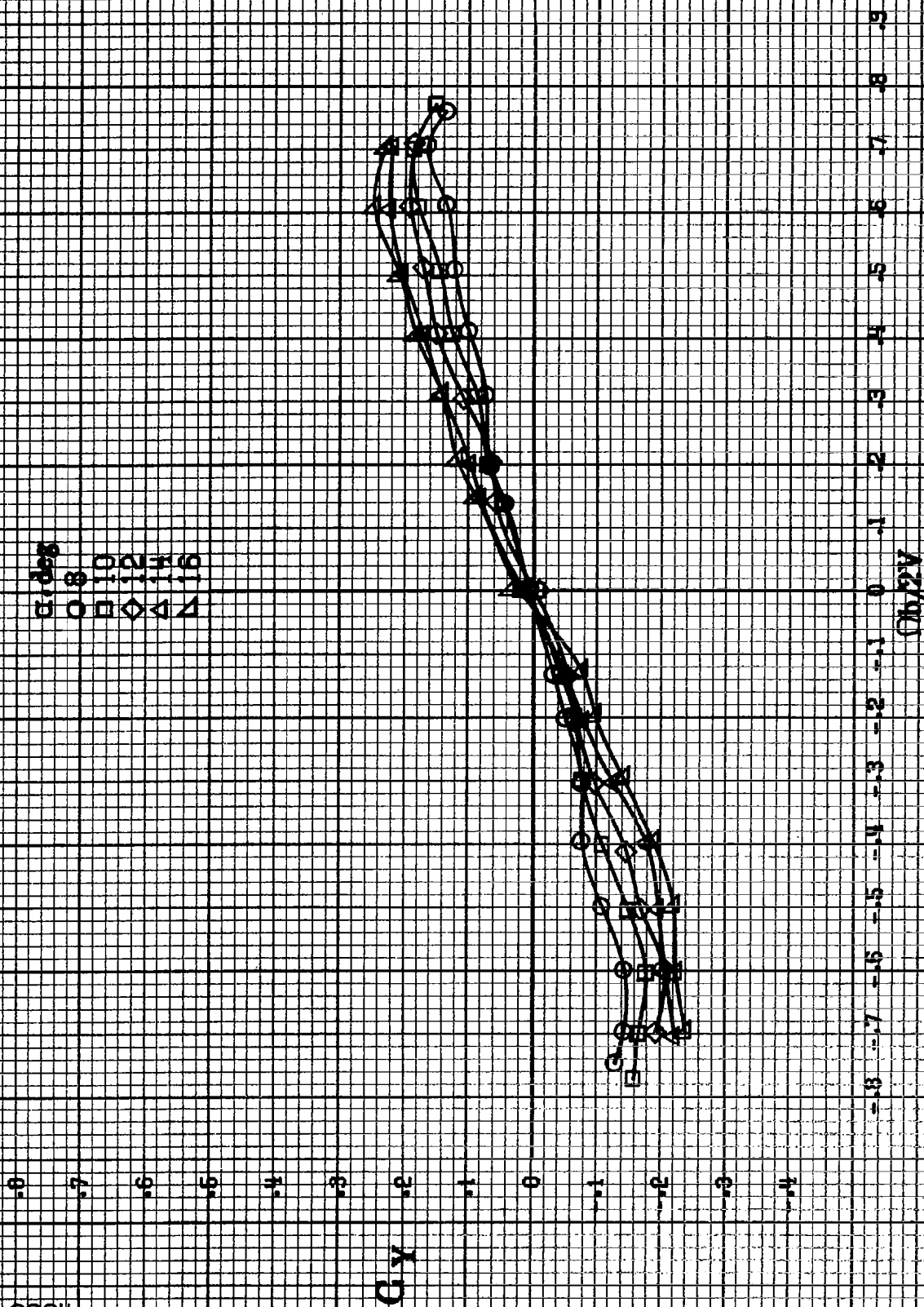
(b)  $\alpha = 18$  to  $55$  deg,  $SR = 162.9 \text{ cm (72 in)}$   
 Figure A 48.-Continued.



(c)  $\alpha = 30$  to  $50$  deg,  $SR = 0$ .  
Figure A46.-Continued.



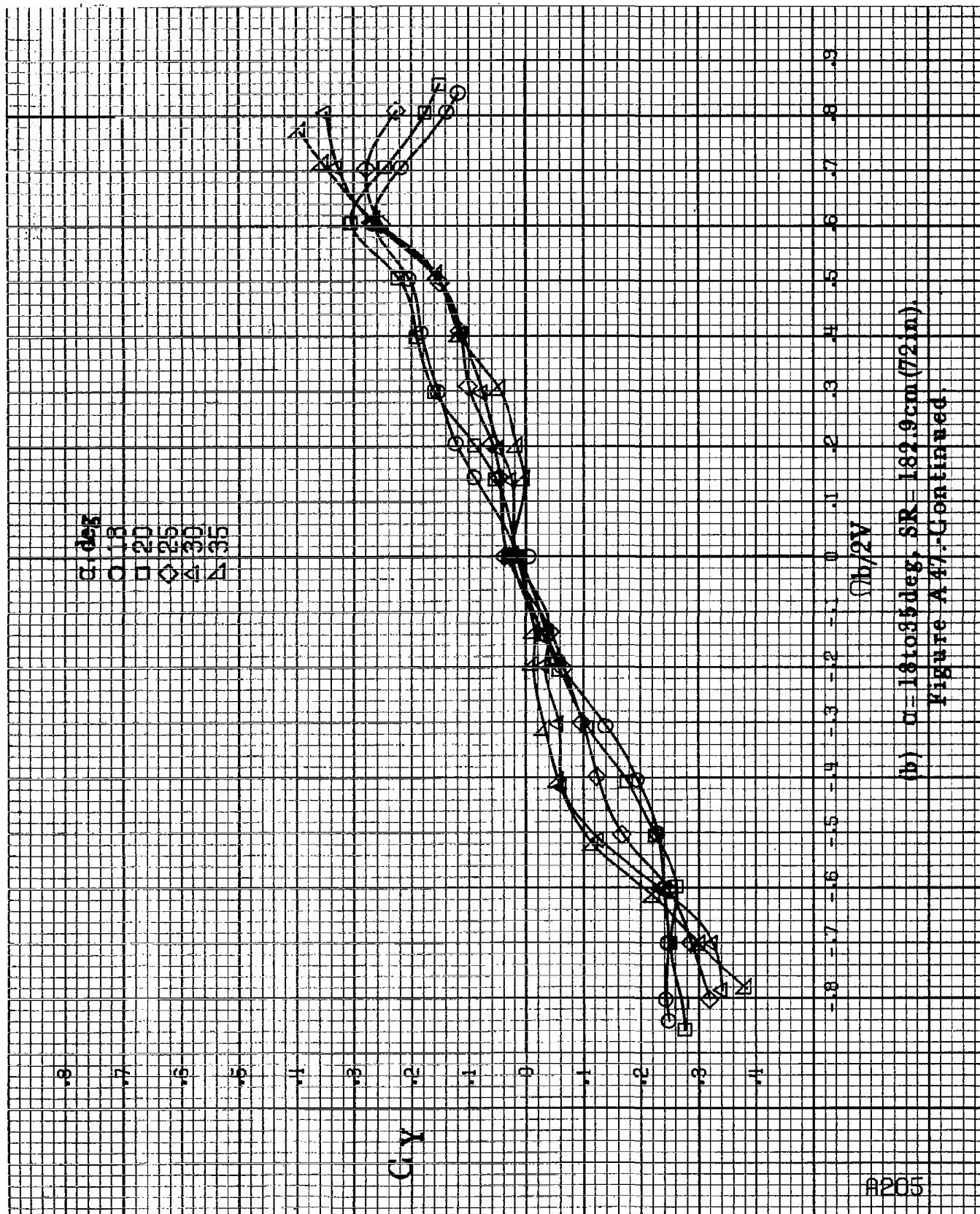
(d)  $\alpha = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A 46. Concluded.



(4)  $\alpha = 8$  to  $16$  deg,  $SR = 1.92$ ,  $9$  cm ( $72$  in).

Figure A17. Effect of rotation rate and angle of attack on side-force coefficient for full-span ILE wing droop with large nose radius and sharp-edged fuselage bottom.  $\delta_1 = 0^\circ$ ,  $\delta_2 = 0^\circ$ ,  $\delta_3 = 0^\circ$ ,  $\delta_4 = 0^\circ$ .





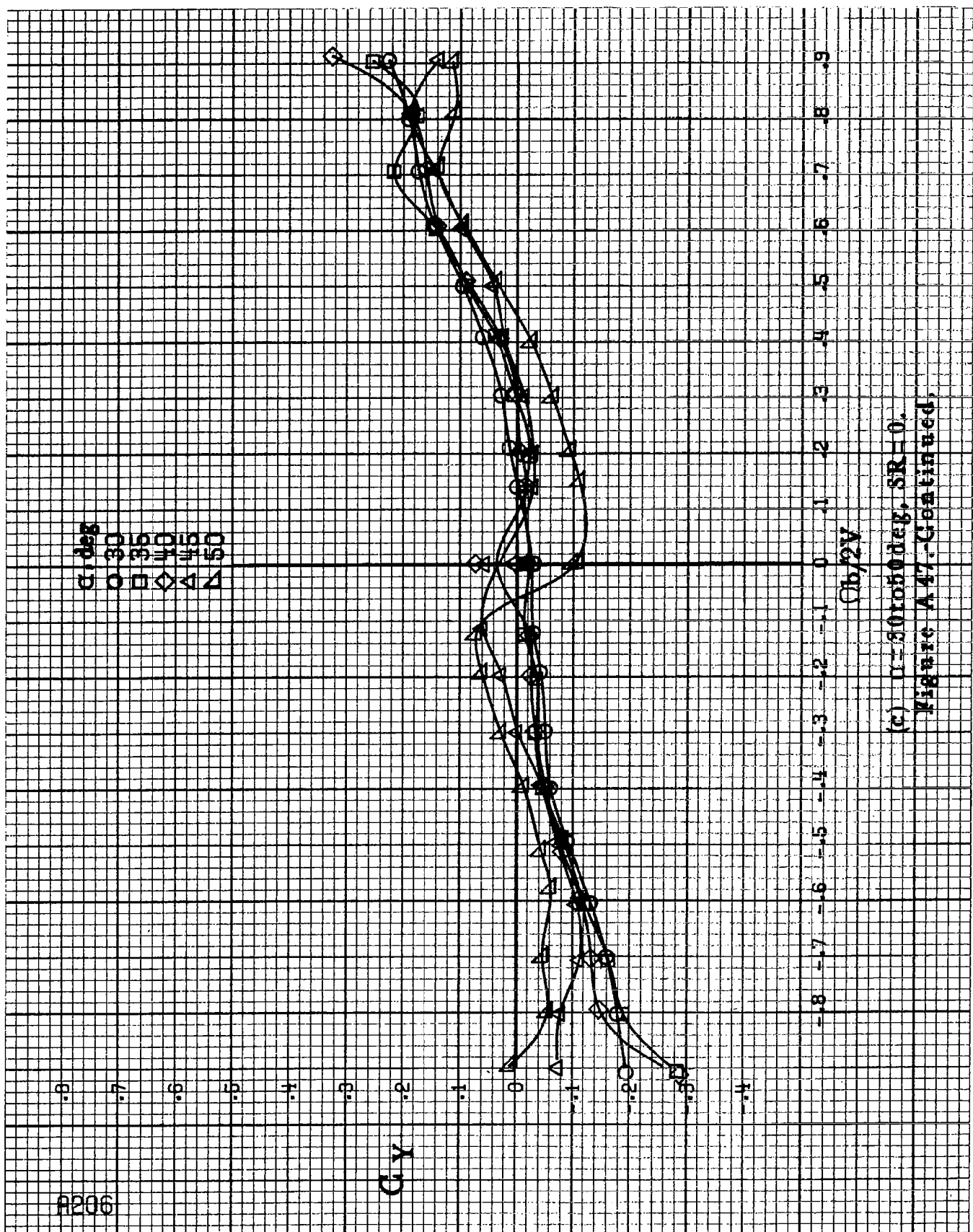
(b)  $\alpha = 18$  to  $35^\circ$ ,  $SR = 182.9 \text{ cm (72 in.)}$   
 Figure A 47.-Continued.

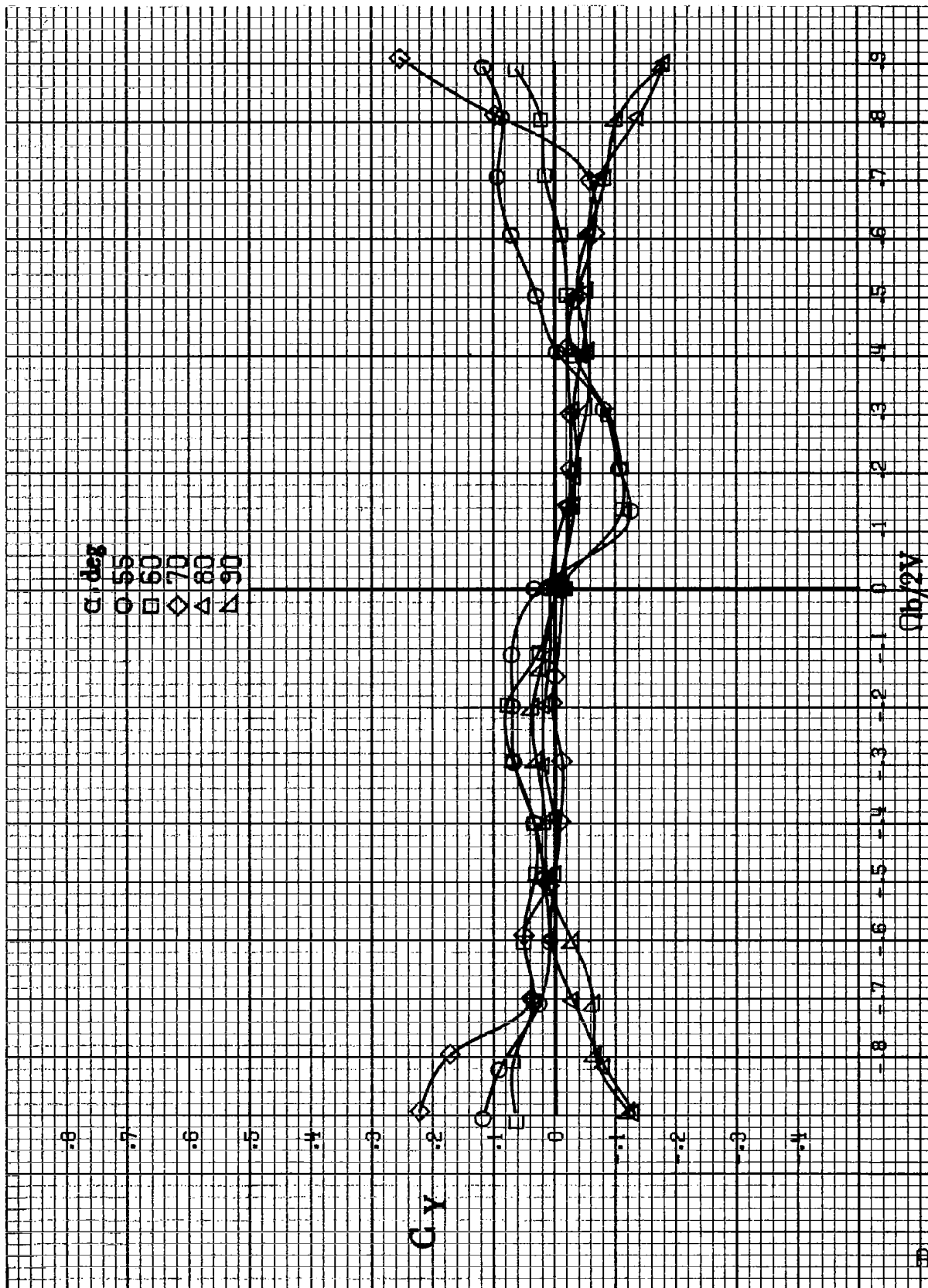
$\alpha$ , deg  
 ○ 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▽ 50

$C_Y$

$C_{b/2V}$

(c)  $\alpha = 30$  to  $50$  deg,  $SR = 0$ .  
 Figure A 47. Continued.



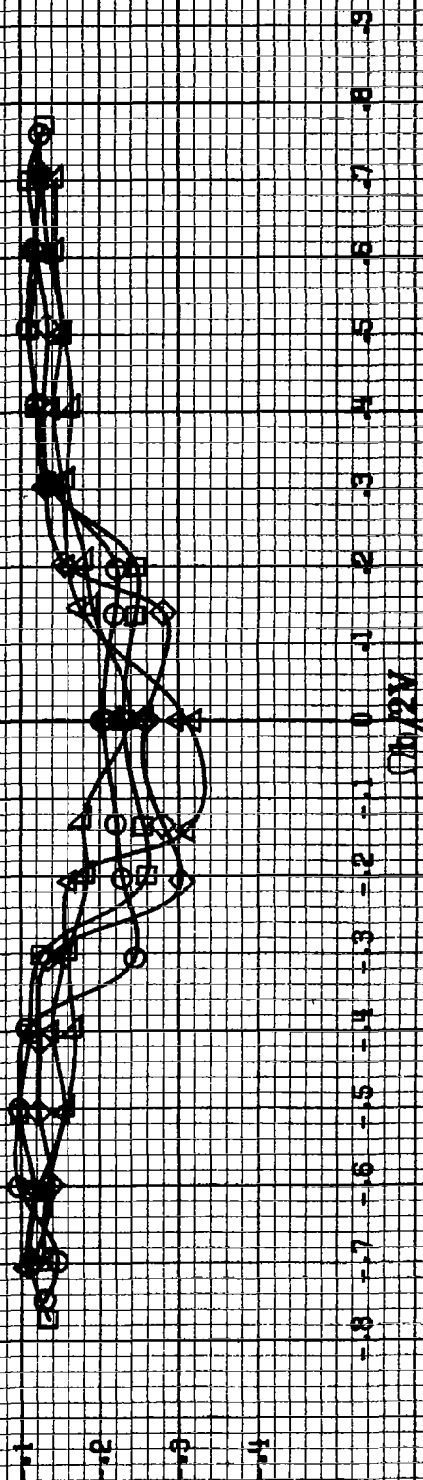


(d)  $1 \pm 55$  to  $90^\circ$  deg,  $SR=0$ .  
Figure A47. Concluded.

8208

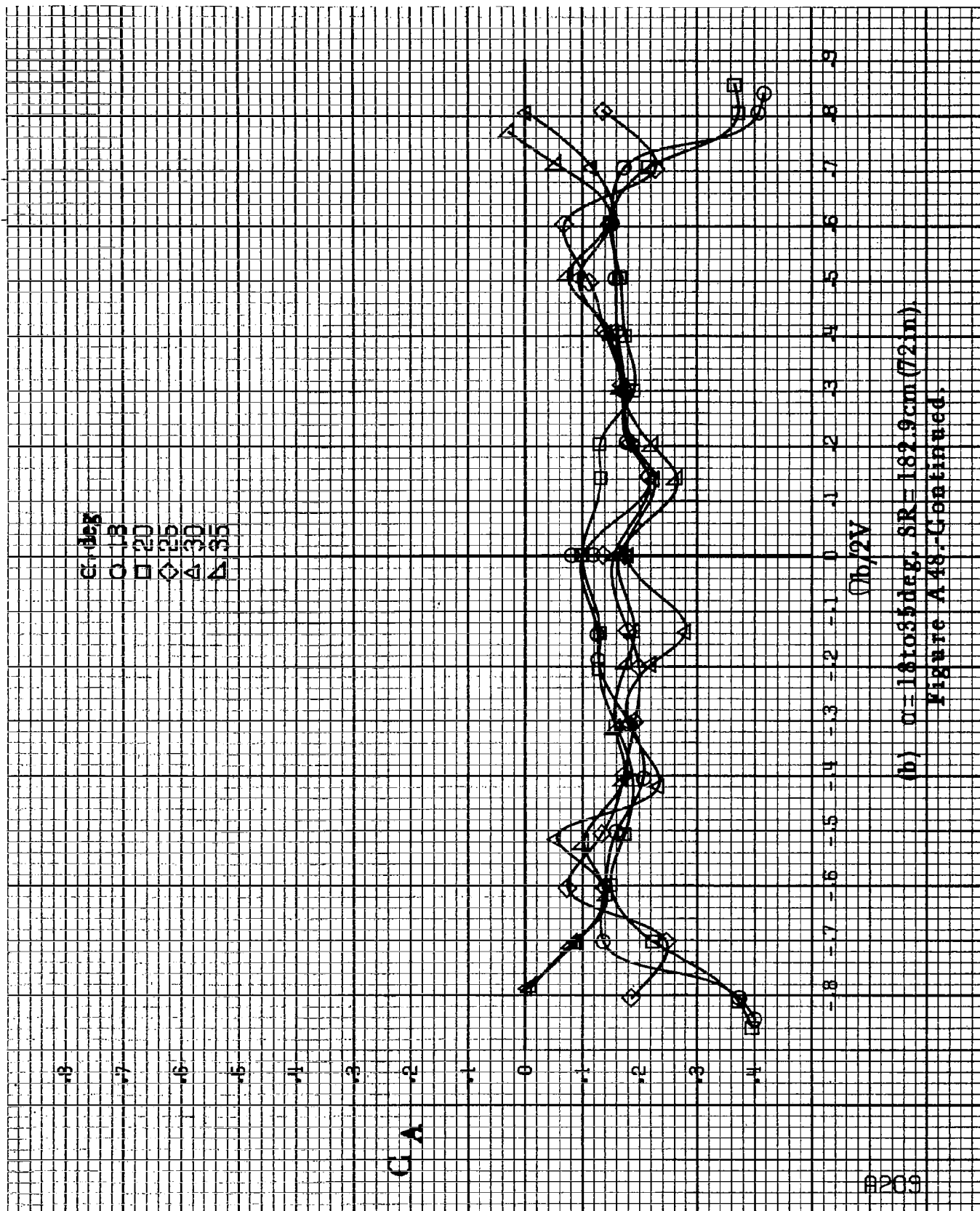
$\alpha$  deg  
 ○ 8  
 ○ 10  
 ◇ 12  
 △ 14  
 ▽ 16

$C_A$



(a)  $\alpha=8$  to  $16$  deg,  $SR=132.9$  cm (72 in).

Figure A48. Effect of rotation rate and angle of attack on stall-force coefficient for full-span LE wing droop with large nose radius and sharp-edged fuselage bottom.  $\delta_x=0^\circ$ ,  $\delta_h=0^\circ$ ,  $\delta_x=0^\circ$ ,  $\delta_h=0^\circ$ .



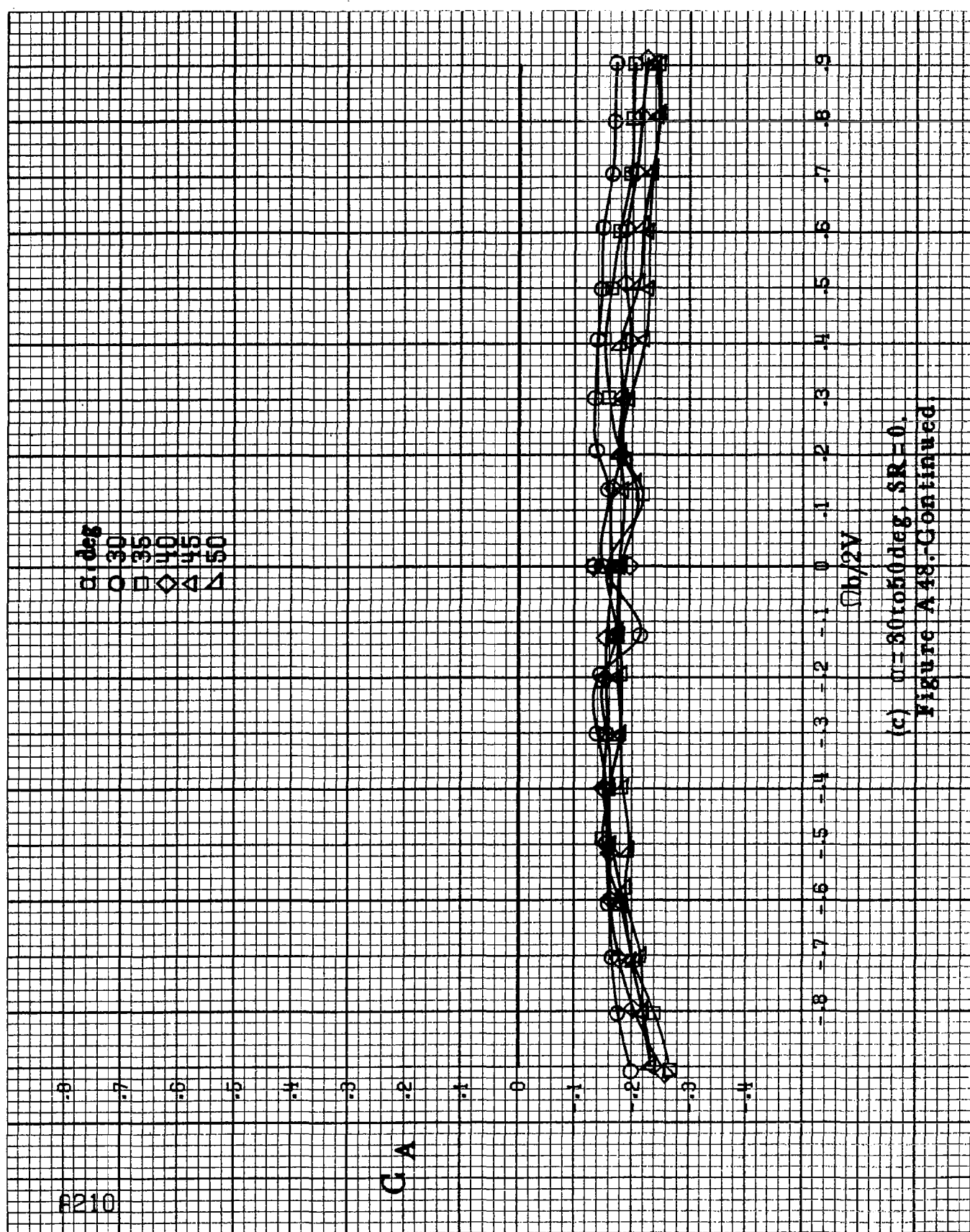
B210

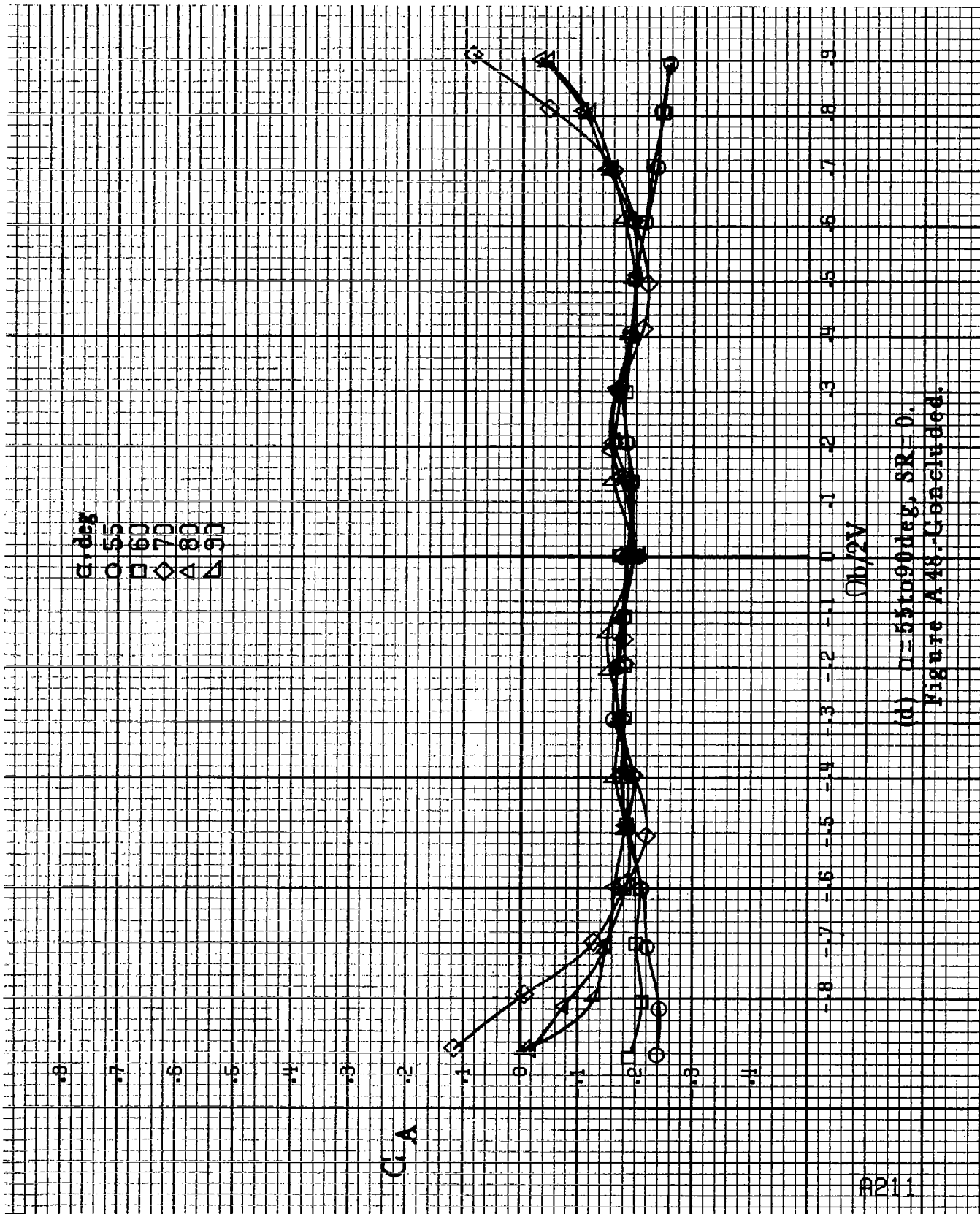
C.A

$\alpha$ , deg  
 O 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▽ 50

$\Omega b/2V$

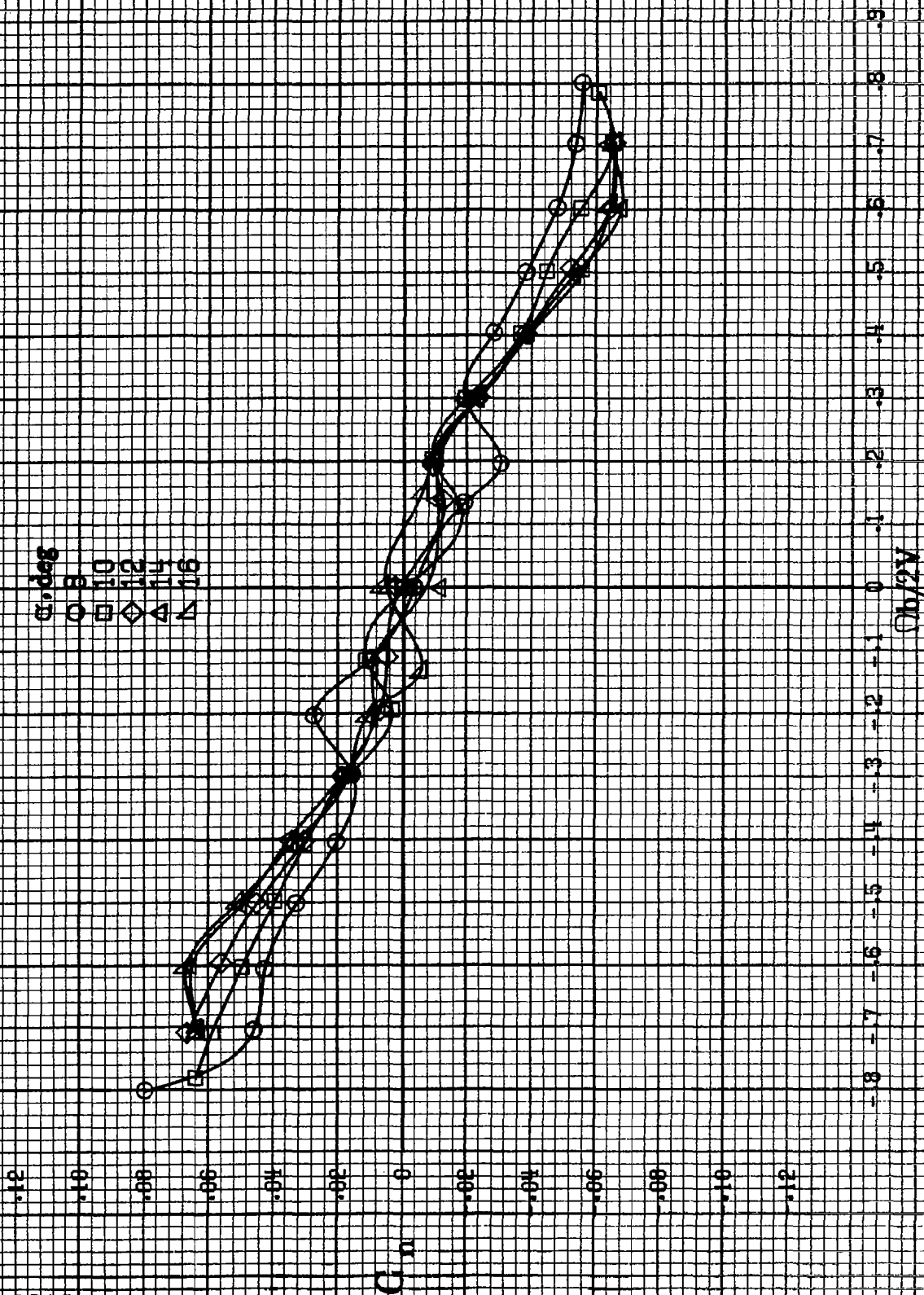
(c)  $\omega = 30$  to  $50$  deg,  $SR = 0$ .  
 Figure A48-Continued.





(d)  $\alpha = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A 48.-Continued.

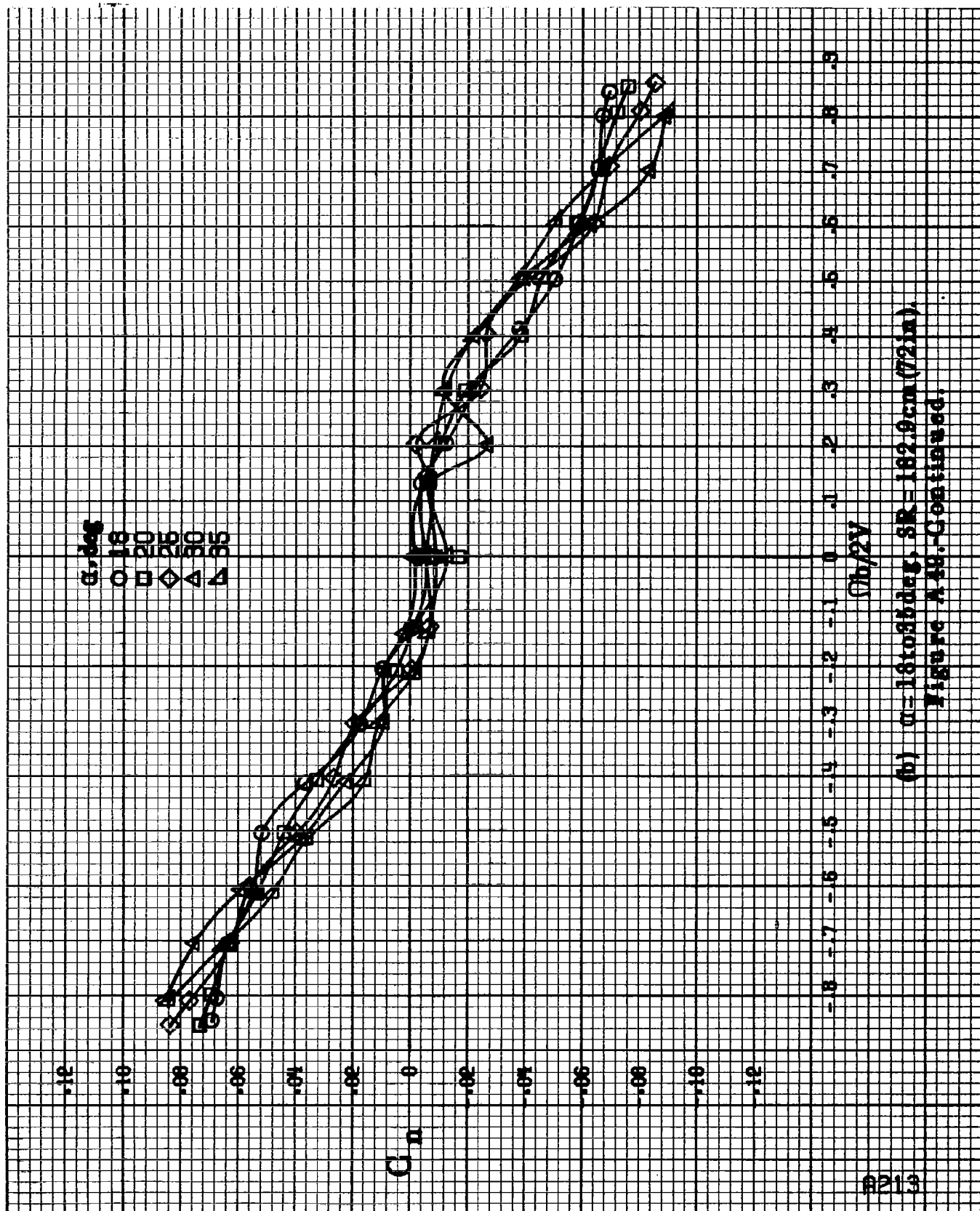
8212



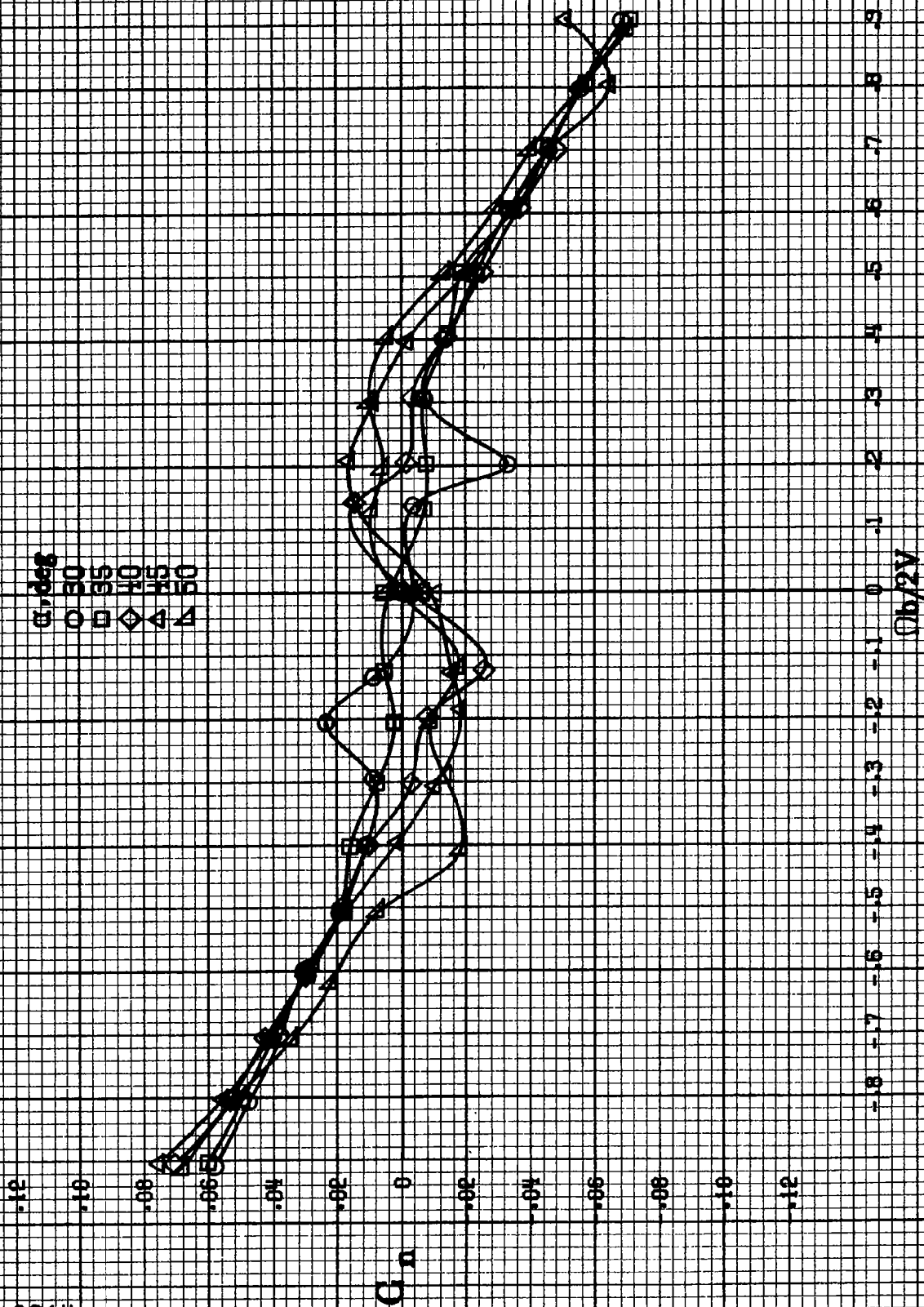
(a)  $\alpha = 8$  to  $16^\circ$ , SR = 132.9 cm (72 in).

Figure A49. Effect of rotation rate and angle of attack on yawing-moment coefficient for ourboard LE wing droop with large nose radius and inboard fairing.  $\delta_a = 0^\circ$ ,  $\delta_s = 0^\circ$ ,  $\delta_r = 0^\circ$ ,  $\beta = 0^\circ$ .

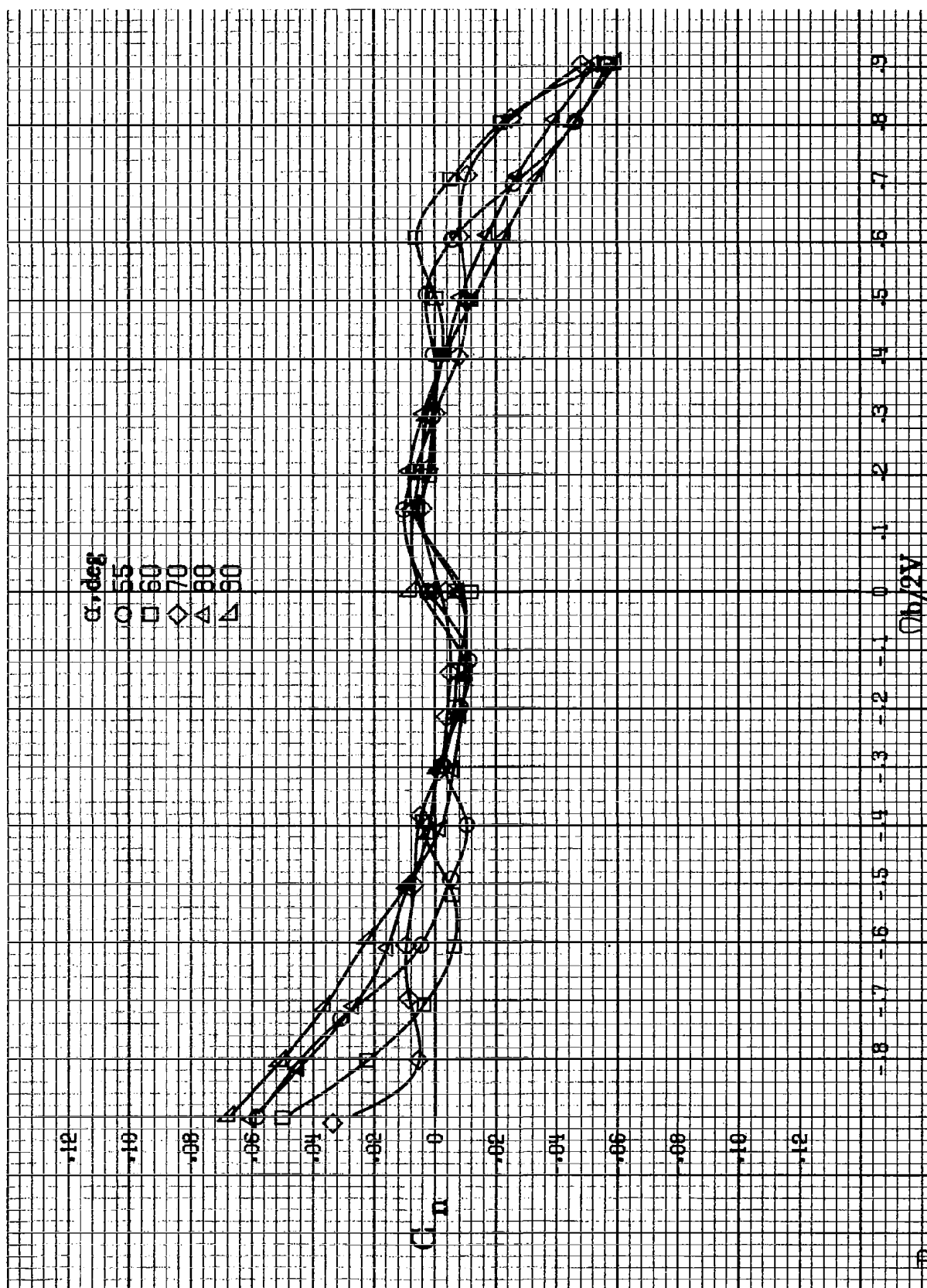




(b)  $\alpha = 18$  to  $35$  deg,  $SR = 162.9$  cm (72 in).  
Figure A48-Continued.



(c)  $\nu=30$  to  $50$  deg,  $SR=0$ .  
Figure A 49.-Continued.



(d)  $U=55$  to  $90^\circ$ ,  $SR=0$ .  
Figure A49.-Concluded.

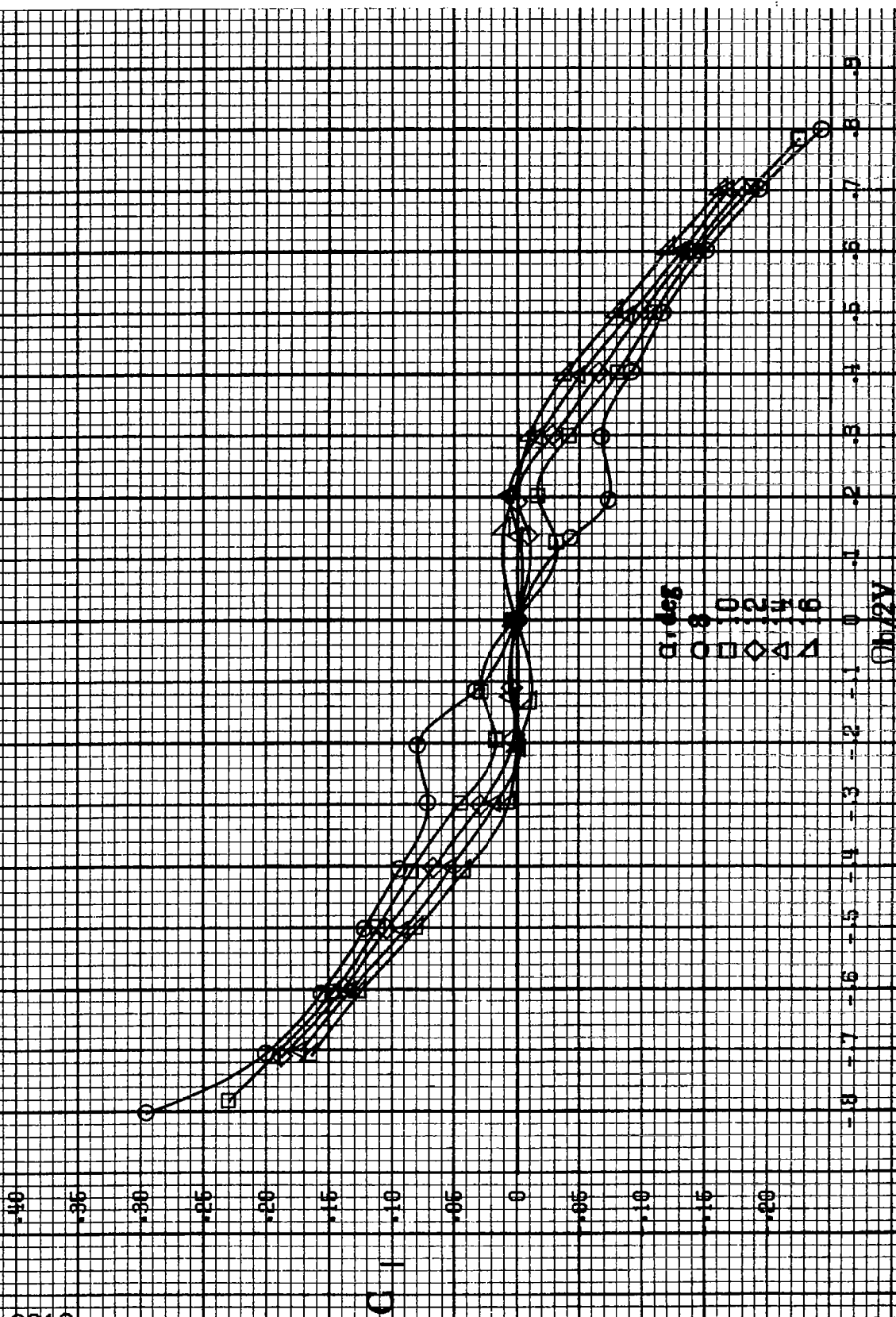
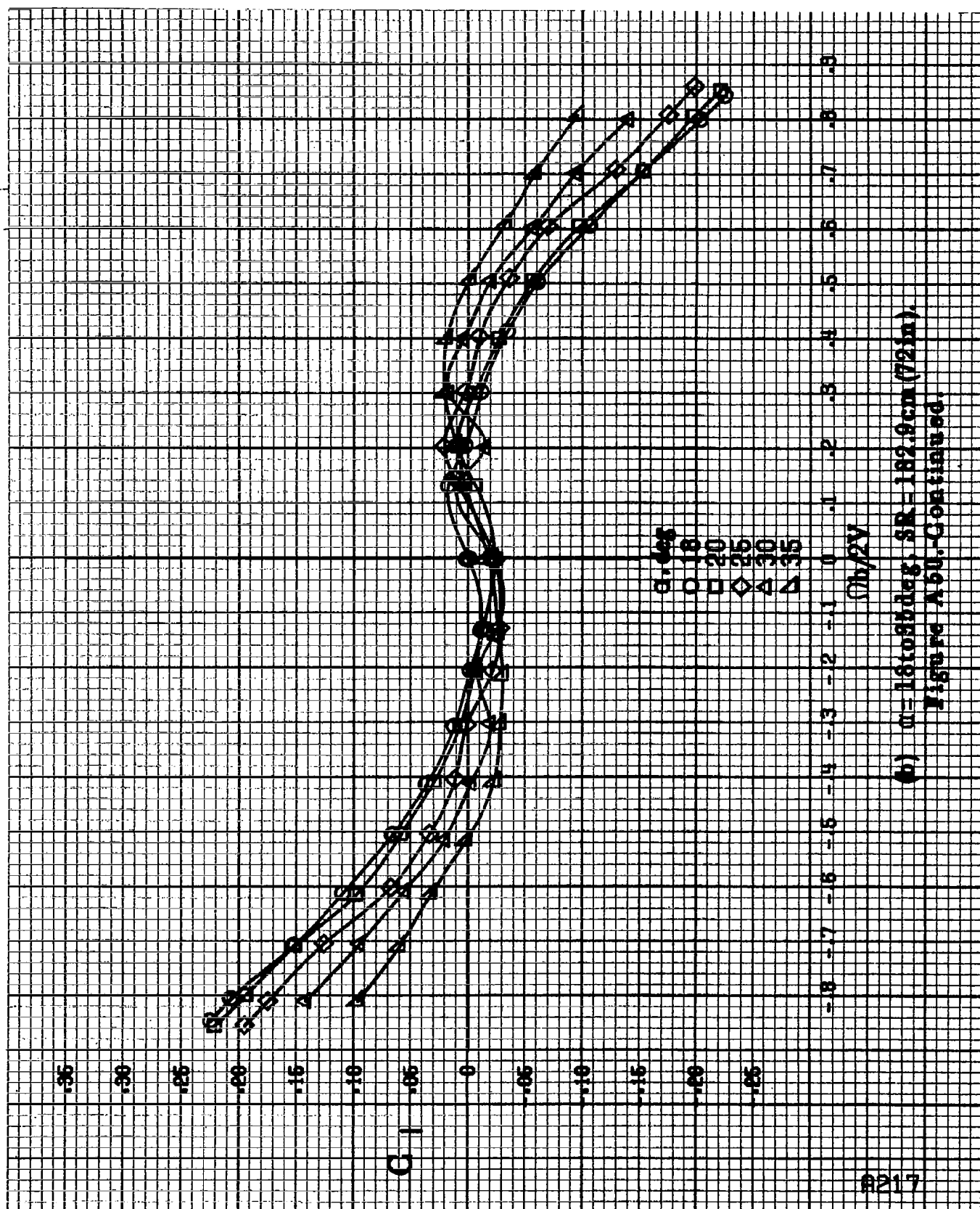


Figure A50. Effect of rotation rate and angle of attack on rolling-moment coefficient for outboard lift wing droop with large nose radius and inboard fairing.  $\alpha = 8^\circ$ ,  $\alpha = 10^\circ$ ,  $\alpha = 12^\circ$ ,  $\alpha = 14^\circ$ ,  $\alpha = 16^\circ$ .  $h = 0.16$  deg,  $h = 182.3$  cm (72 in).

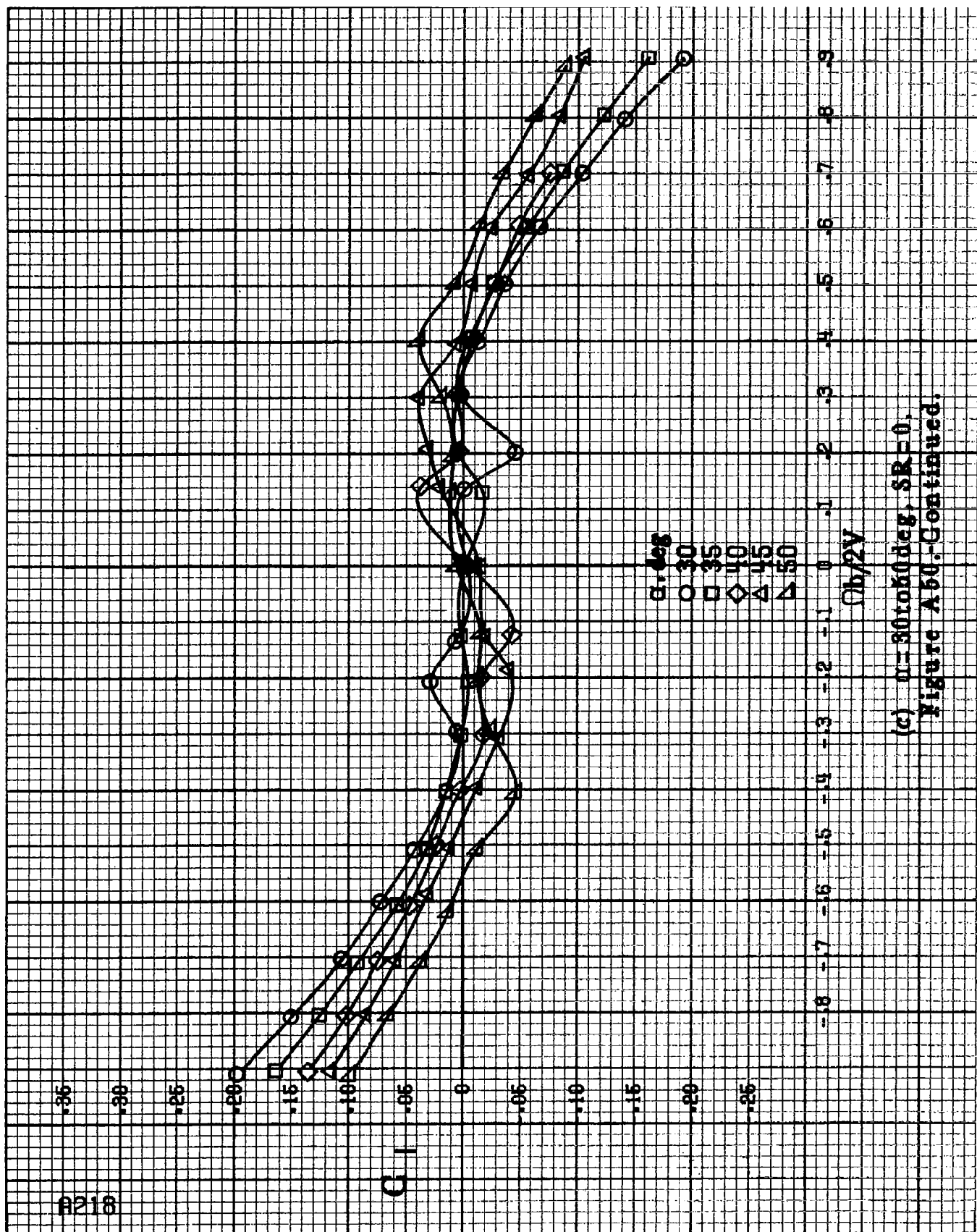


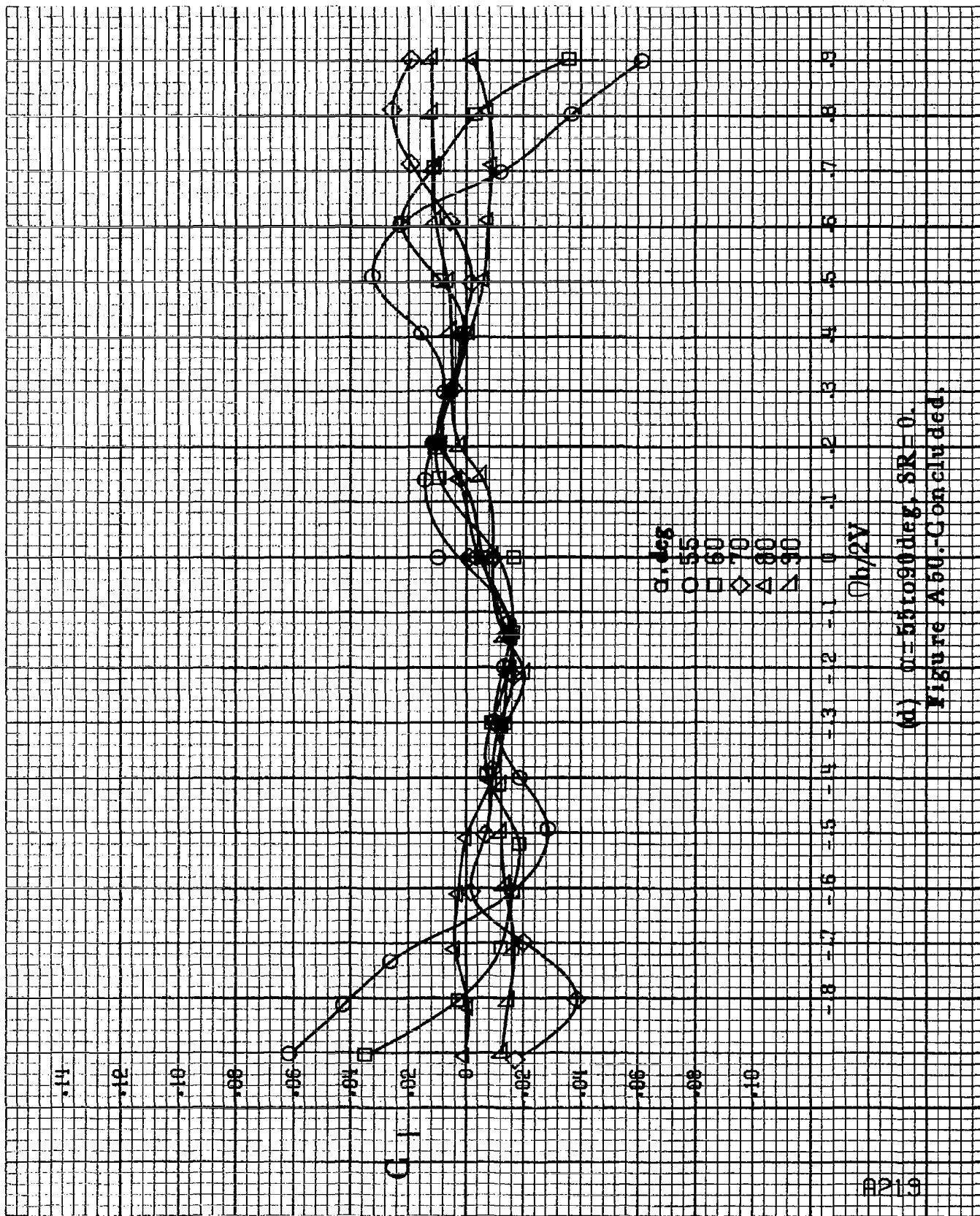
(b)  $\alpha = 18$  to  $35$  deg,  $SR = 182.9$  cm (72 in).  
Figure A5U.-Continued.

$\alpha$ , deg  
 ○ 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▲ 50

$\phi_b/2V$

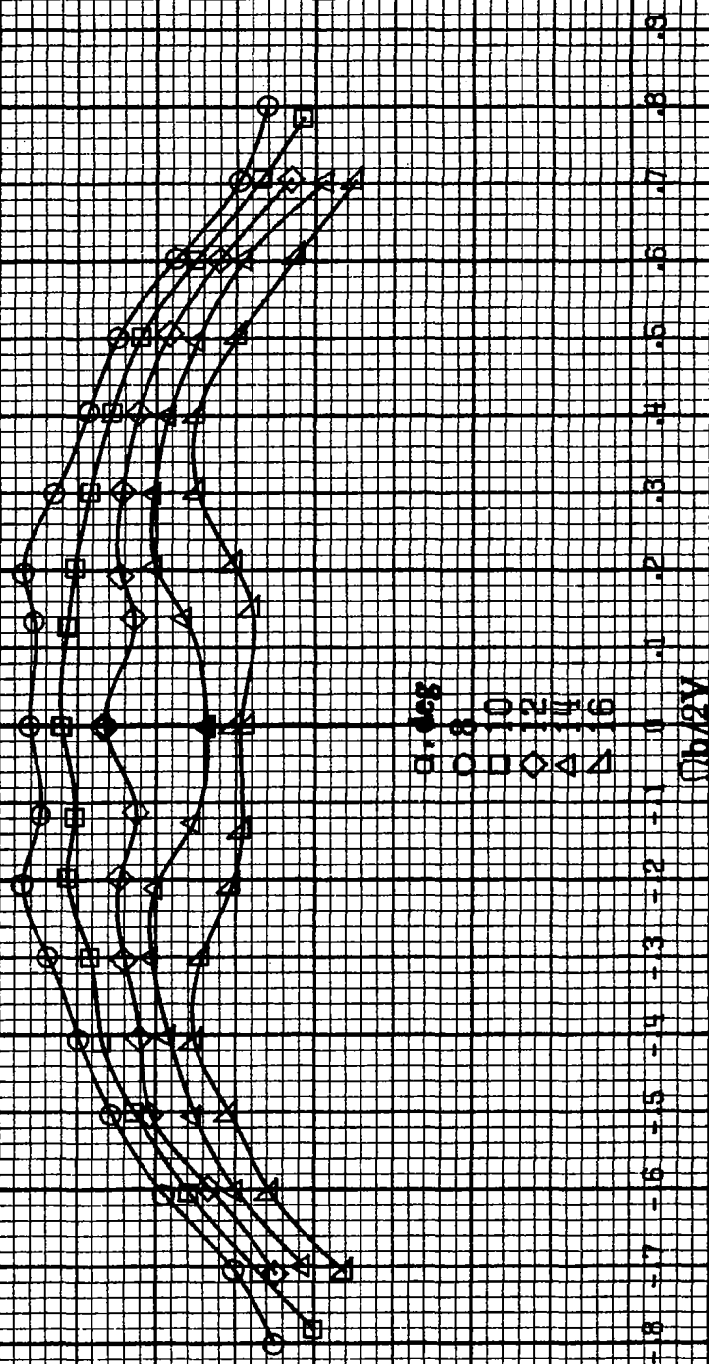
(c)  $\alpha = 30$  to  $50$  deg,  $SR = 0$ .  
 Figure A60. Continued.





(d)  $\alpha = 55$  to  $90$  deg,  $SR = 0$ .  
Figure A60.-Concluded.

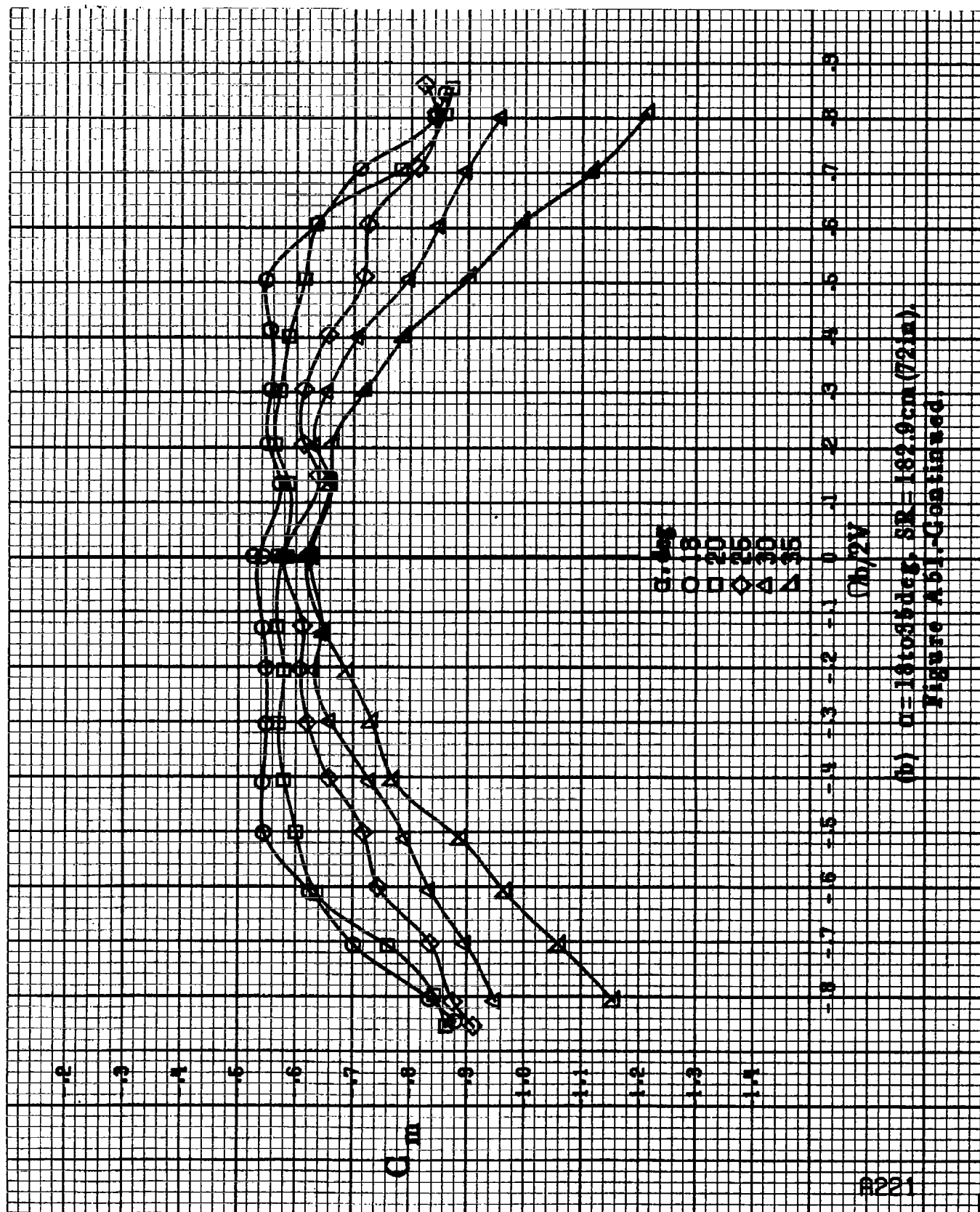
$C_m$



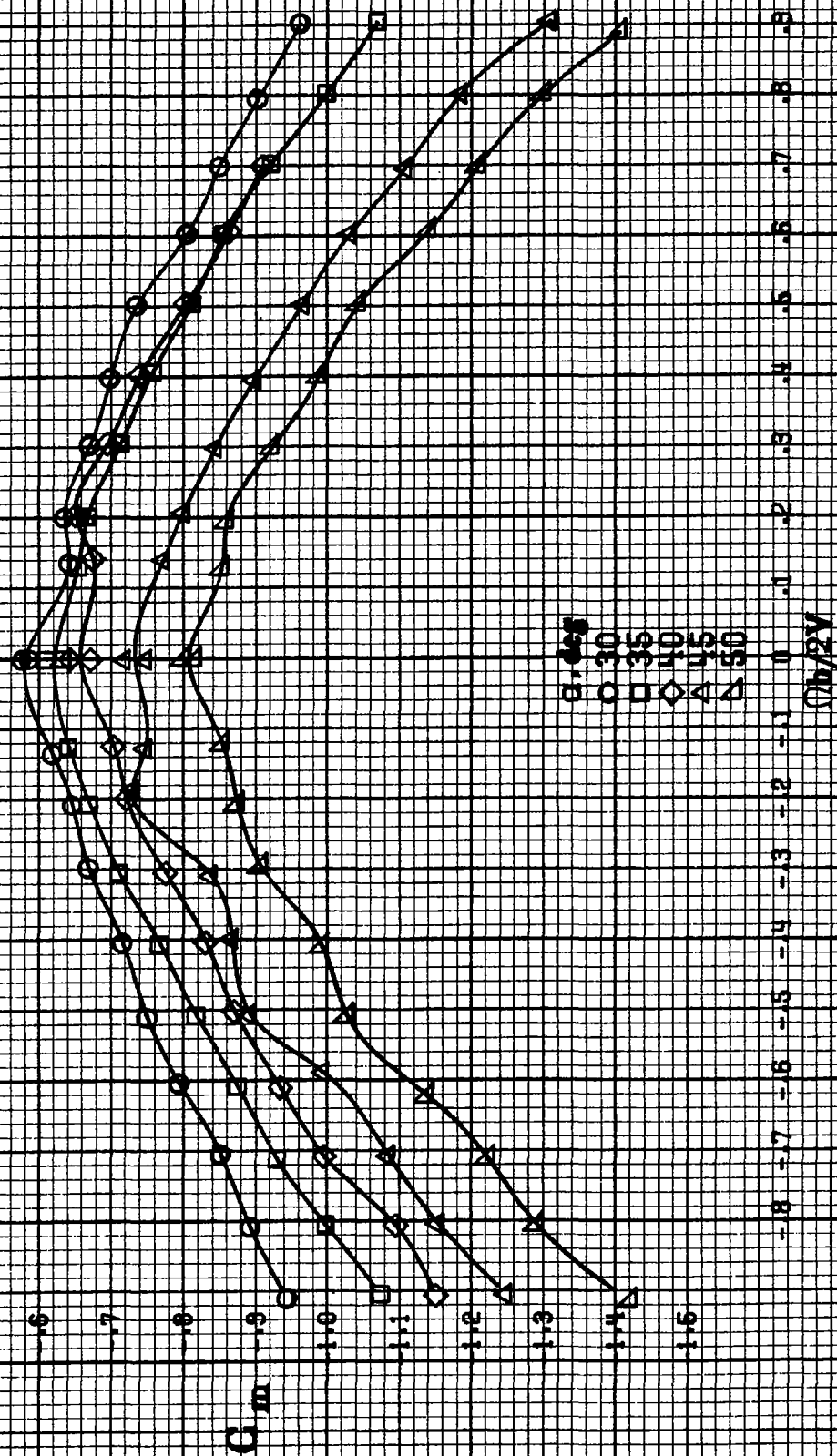
(a)  $\alpha = 8 \pm 1.6$  deg,  $SR = 182.9$  cm (72 in).

Figure A41. Effect of rotation rate and angle of attack on pitching moment coefficient for outboard and inboard wing droop with large nose radius and inboard fairing.  $\delta_1 = 0^\circ$ ,  $\delta_2 = 0^\circ$ ,  $\delta_3 = 0^\circ$ ,  $\delta_4 = 0^\circ$ ,  $\delta_5 = 0^\circ$ .

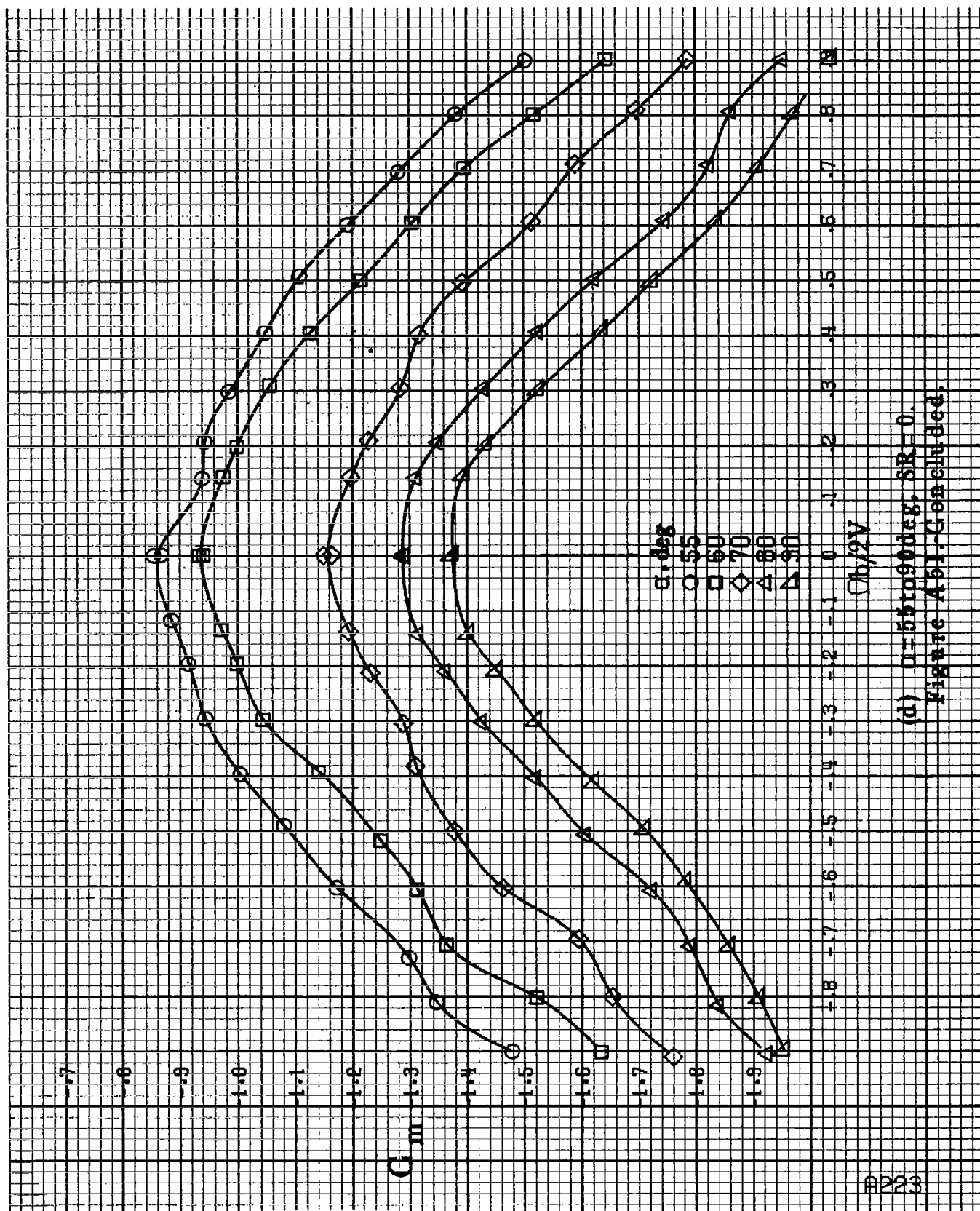




(b)  $\alpha = 18.086 \text{ deg}$ ,  $SR = 162.9 \text{ cm (72 in)}$ .  
Figure A5.1.-Continued.

$C_m$ 

(a)  $\theta = 30$  to  $50^\circ$ ,  $SR = 0$ .  
Figure A61.-Continued.



(d)  $\Omega=551090\text{deg}$ ,  $SR=0$ .  
Figure A51-Continued.

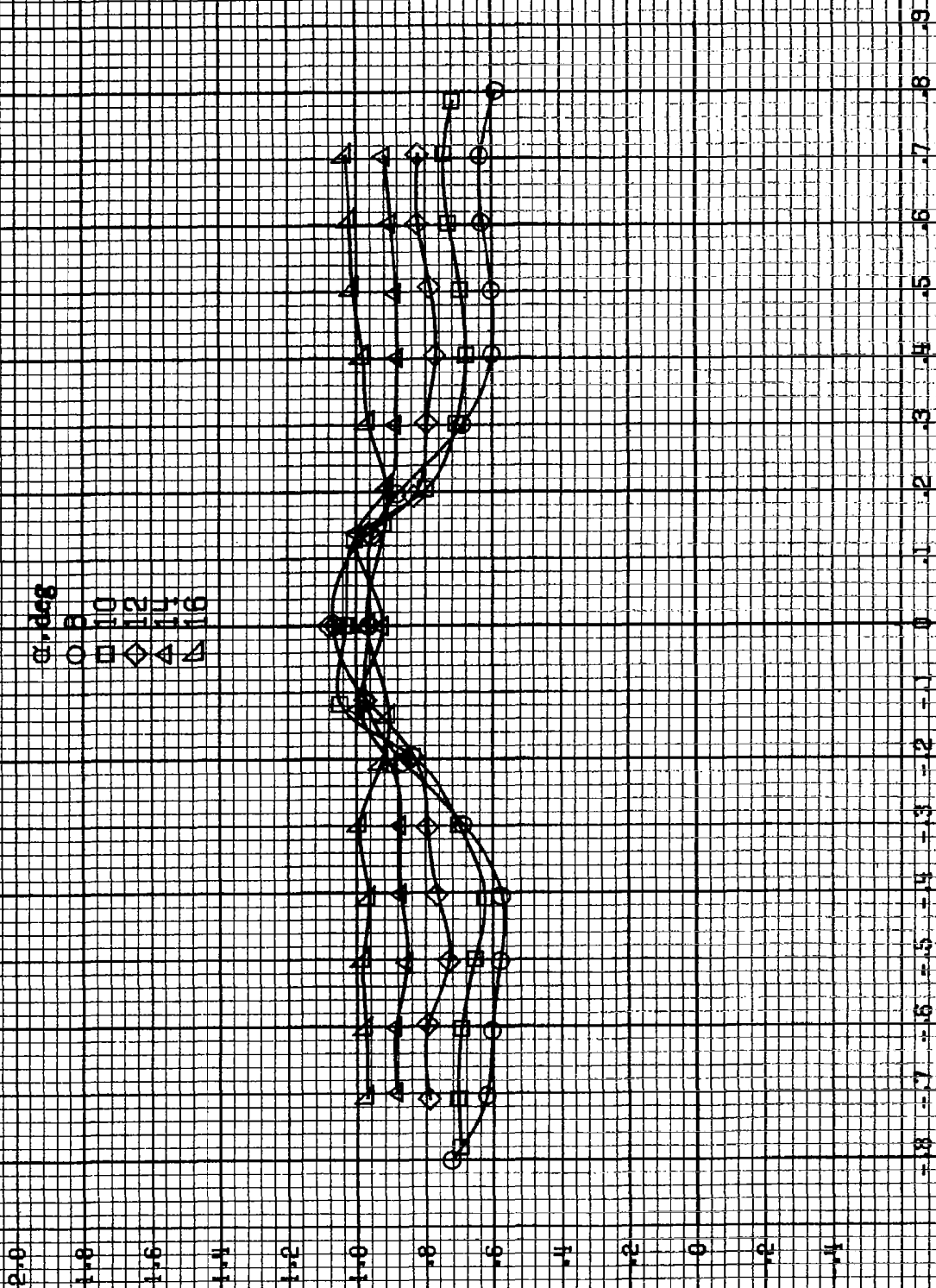
$\alpha, \text{deg}$   
 8  
 10  
 12  
 14  
 16

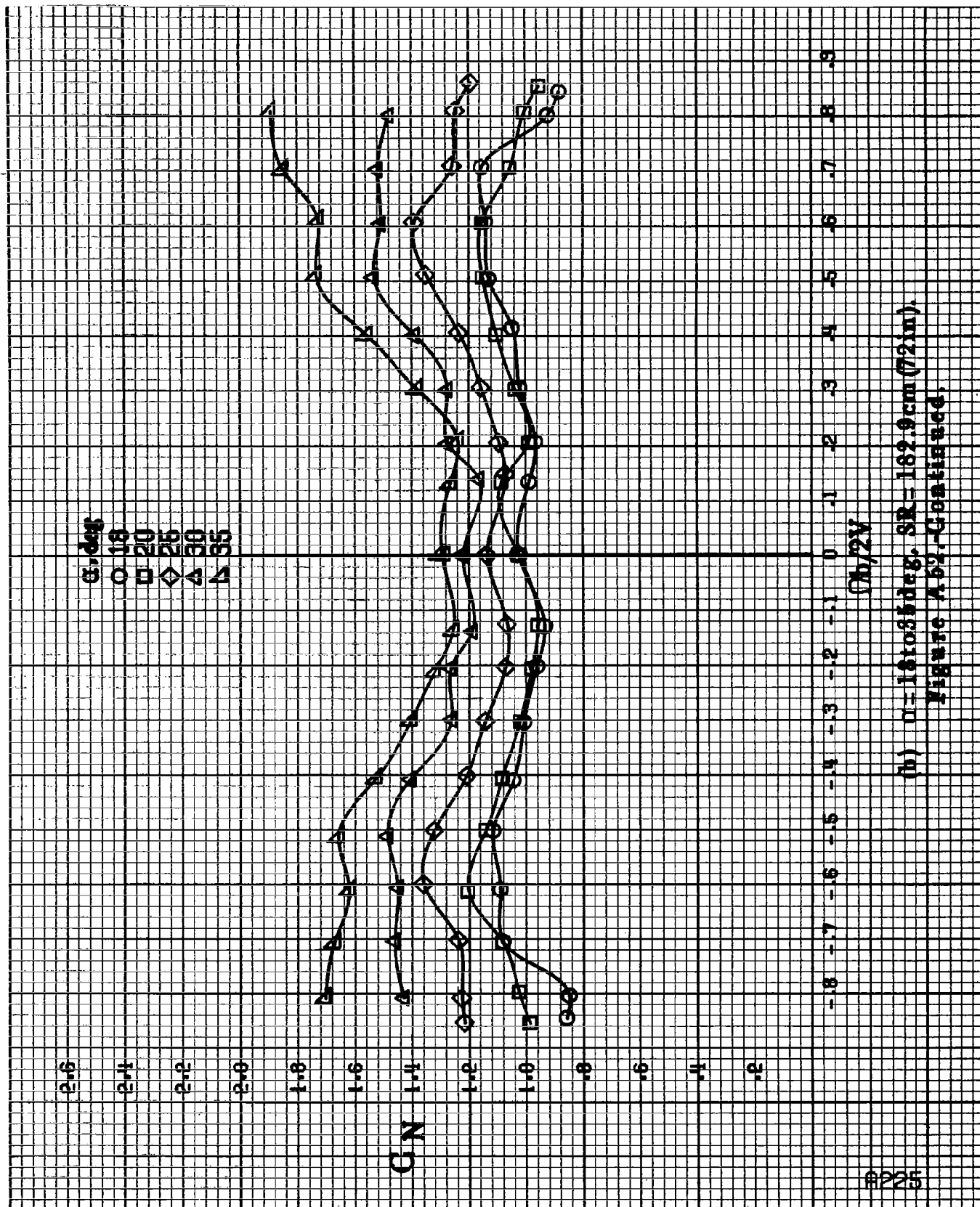
$C_N$

$Ob/2V$

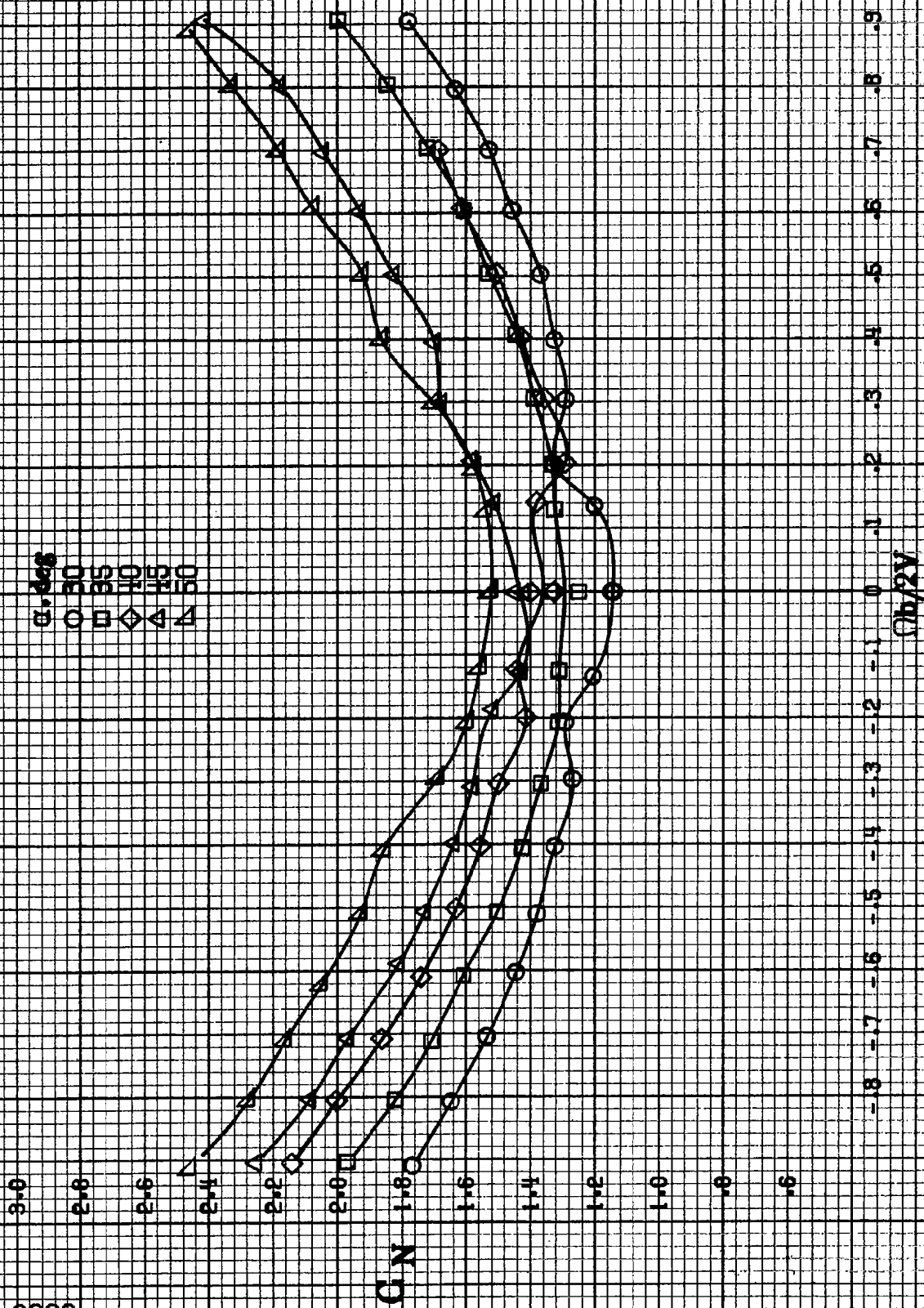
(a)  $\alpha = 8 \text{ to } 16 \text{ deg}$ ,  $SR = 182.9 \text{ cm } (72 \text{ in})$ .

Figure A52. Effect of rotation rate and angle of attack on normal-force coefficient for outboard LR wing droop with large nose radius and inboard fairing.  $\delta_1 = 0^\circ$ ,  $\delta_2 = 0^\circ$ ,  $\delta_3 = 0^\circ$ ,  $\delta_4 = 0^\circ$ .

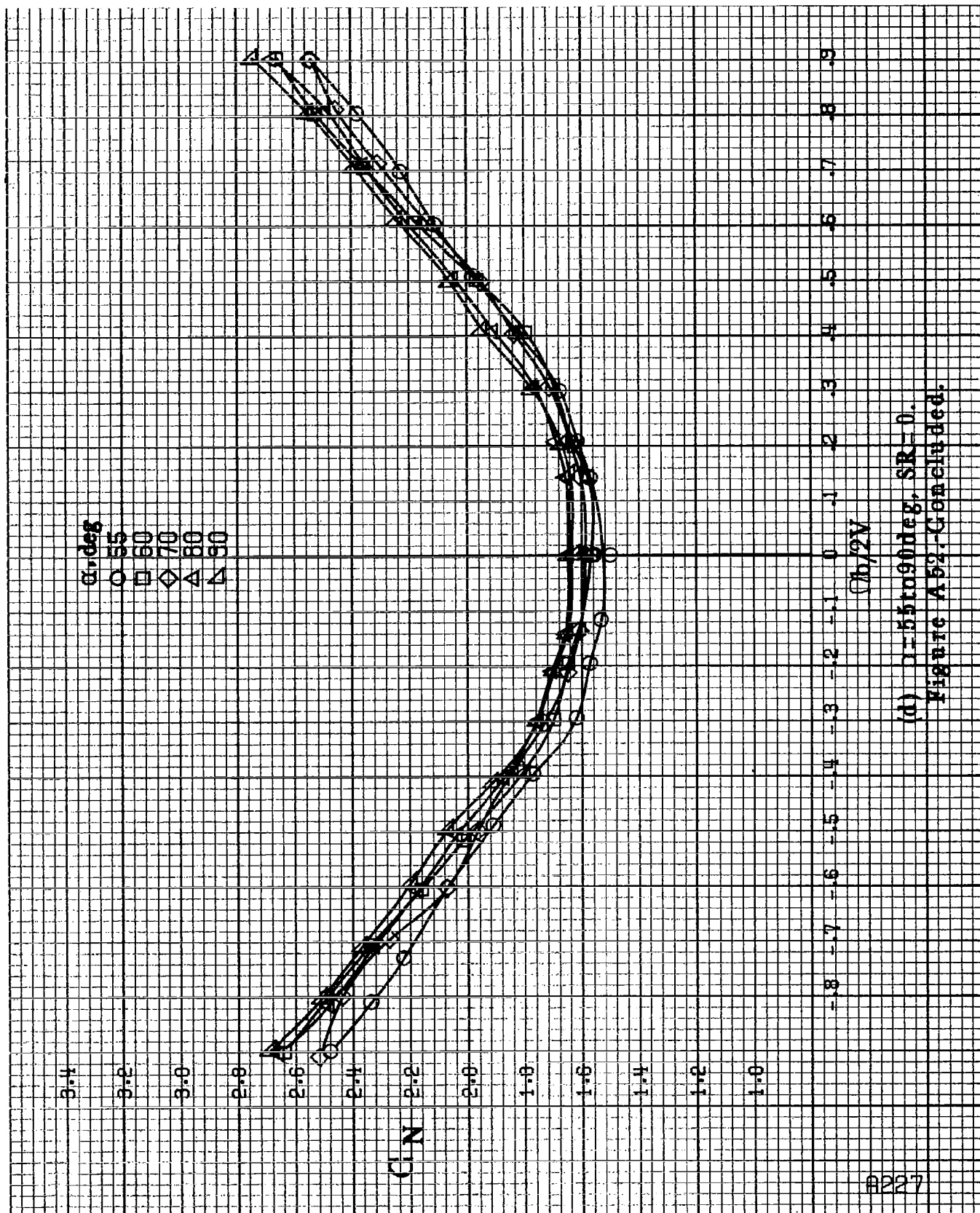




(b)  $\alpha = 1.61035 \text{ deg}$ , SR = 182.9 cm (72 in).  
Figure A52-Continued.

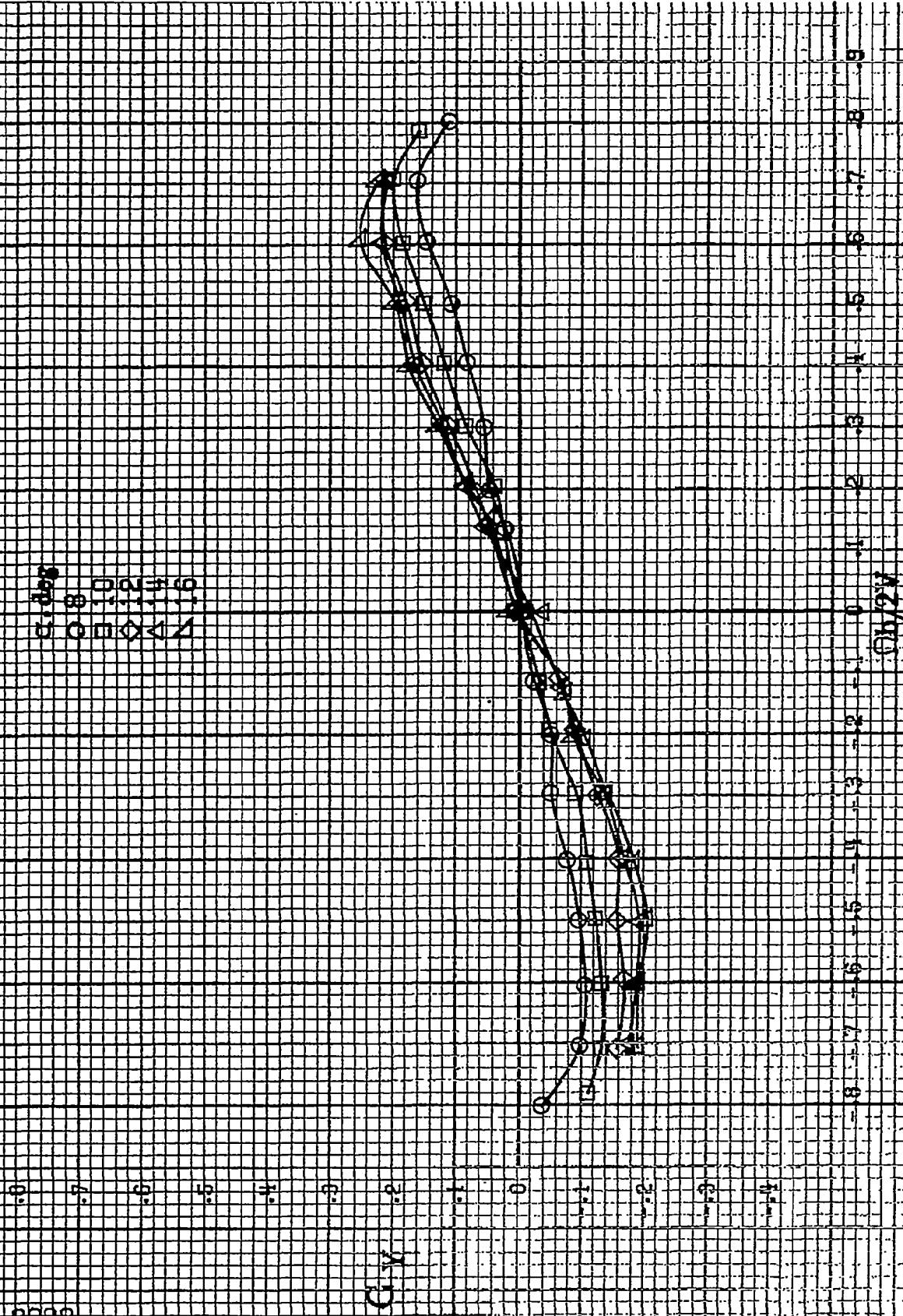


(a)  $\alpha = 30$  to  $60$  deg,  $SR = 0$ .  
Figure A52.-Continued.



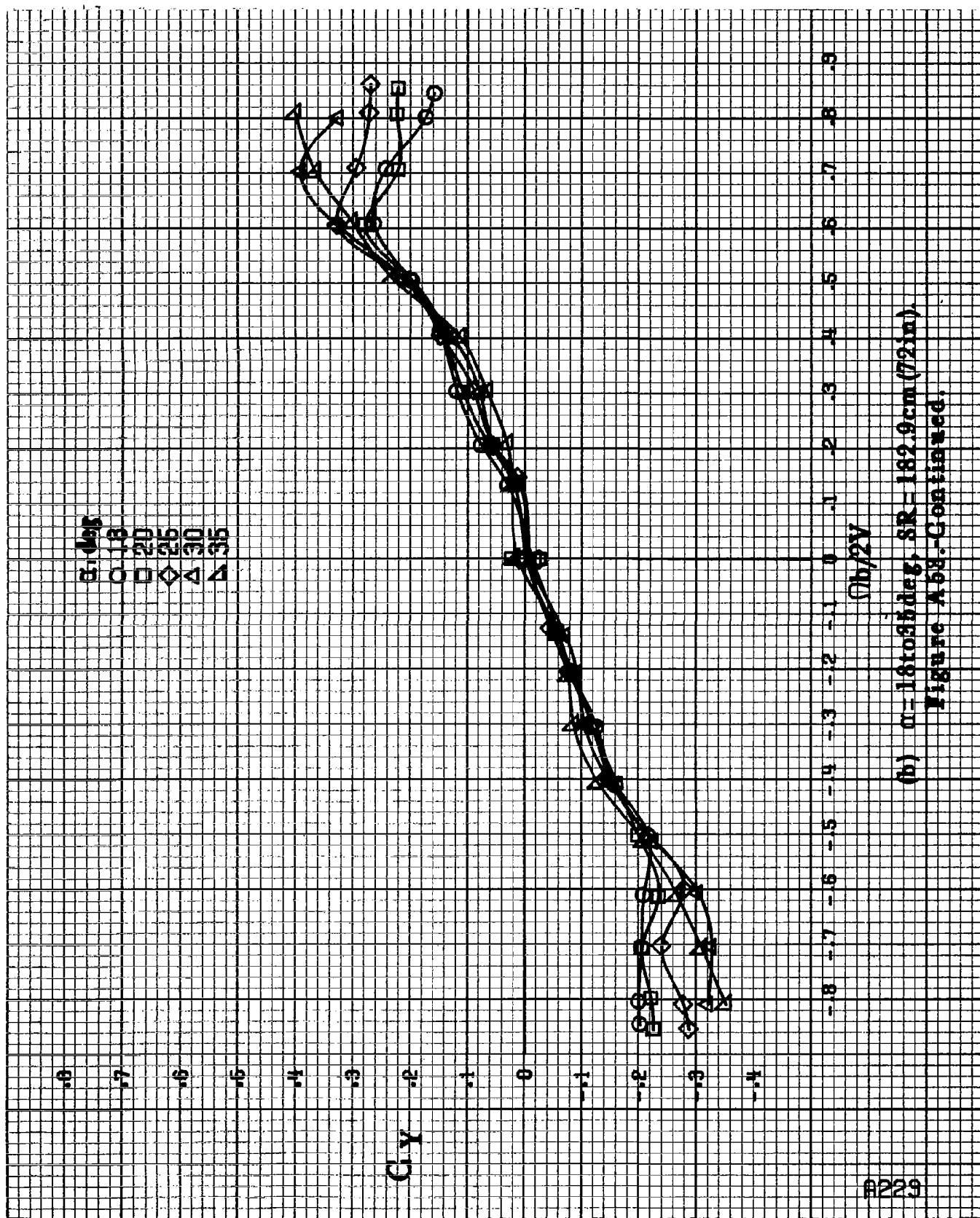
(d)  $\alpha = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A52.-Concluded.

B226



(a)  $\alpha = 8$  to  $16$  deg,  $SR = 182.9$  in (72 in.).  
 Figure 11a: Effect of rotating rate and angle of attack on side force coefficient for onboard LV wing droop with large nose radius and airfoil having  $\delta_n = 0^\circ$ ,  $\delta_n = 0^\circ$ ,  $\delta_n = 0^\circ$ ,  $\delta_n = 0^\circ$ ,  $\delta_n = 0^\circ$ .





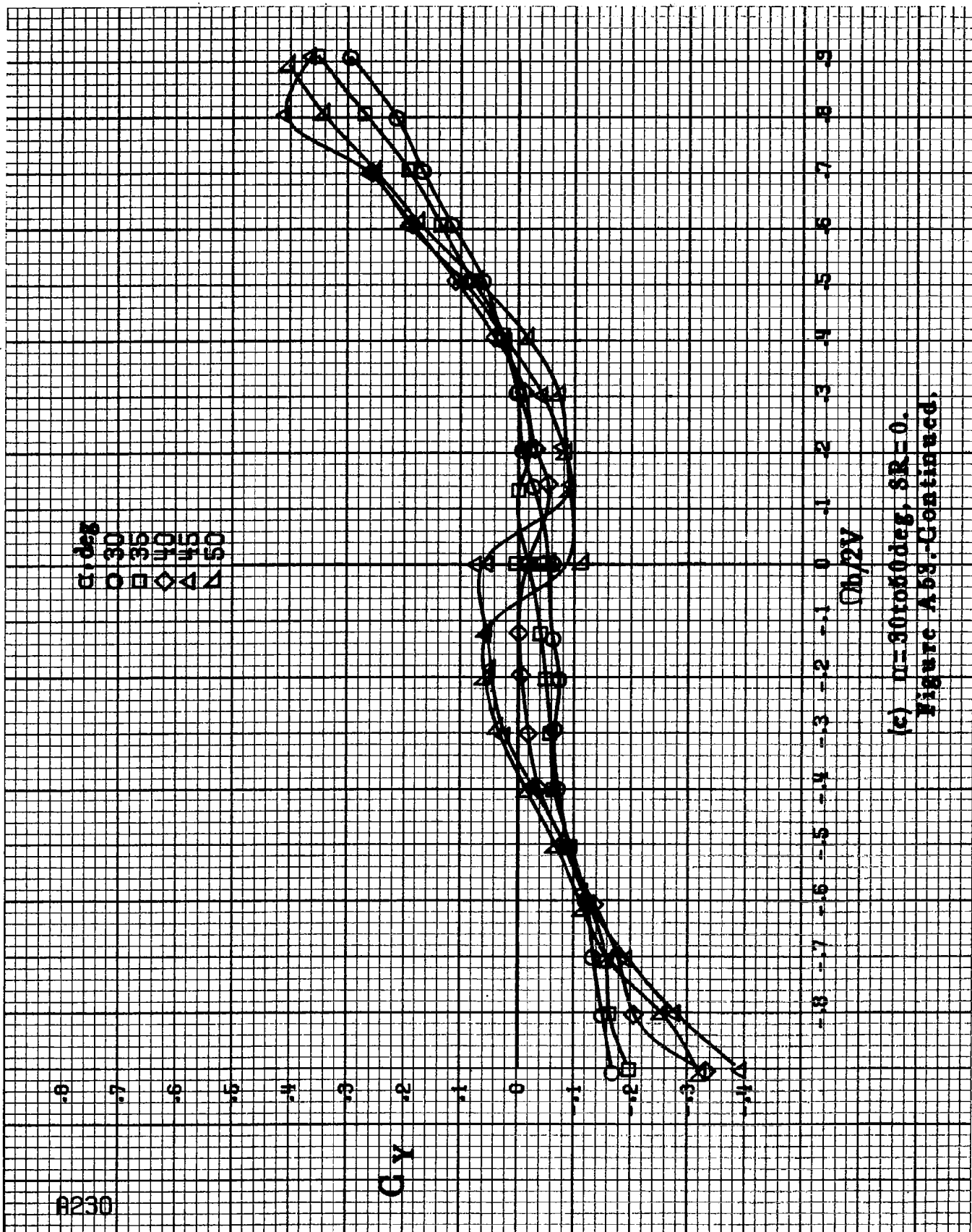
A230

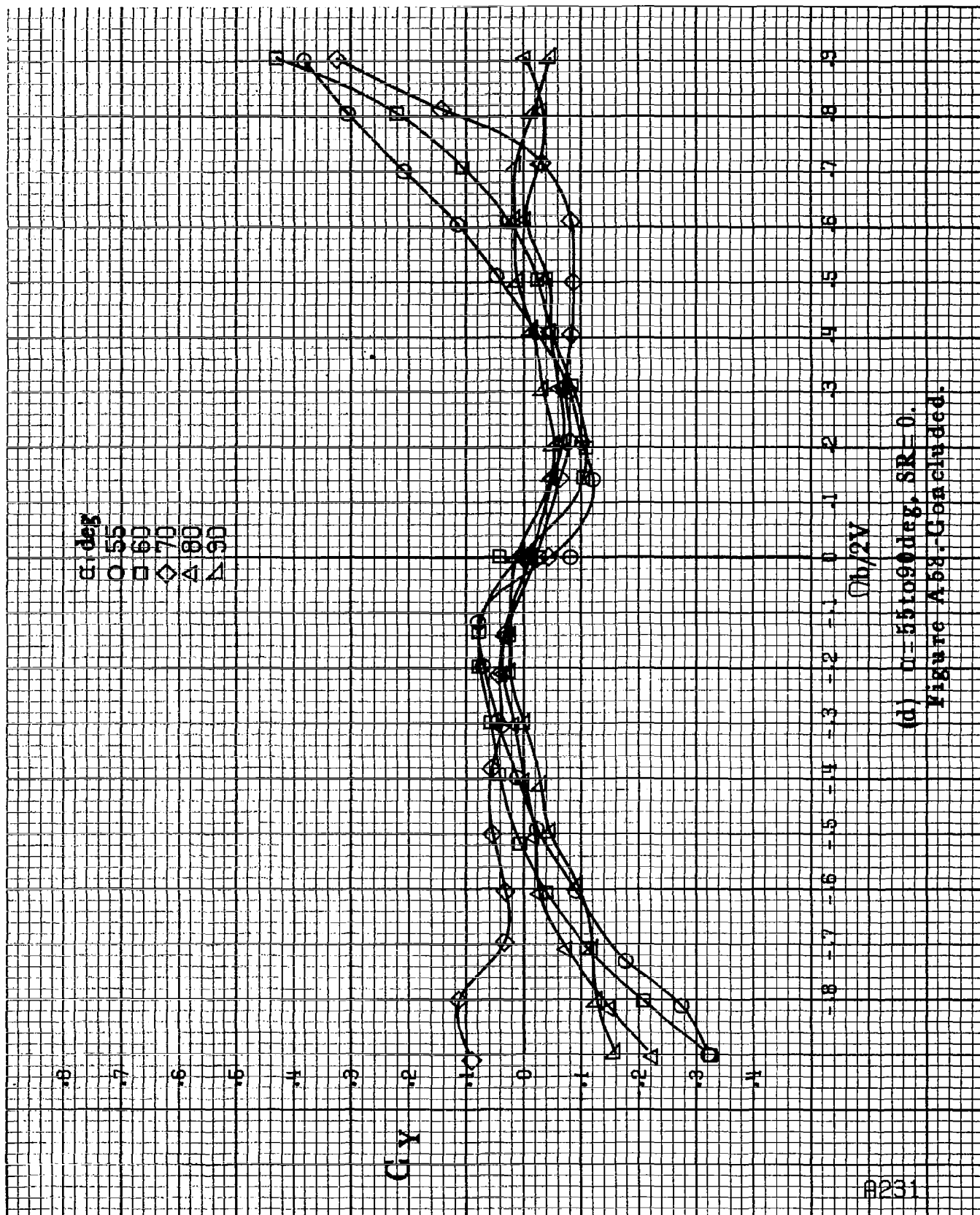
$\alpha, \text{deg}$   
 O 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▽ 50

$C_y$

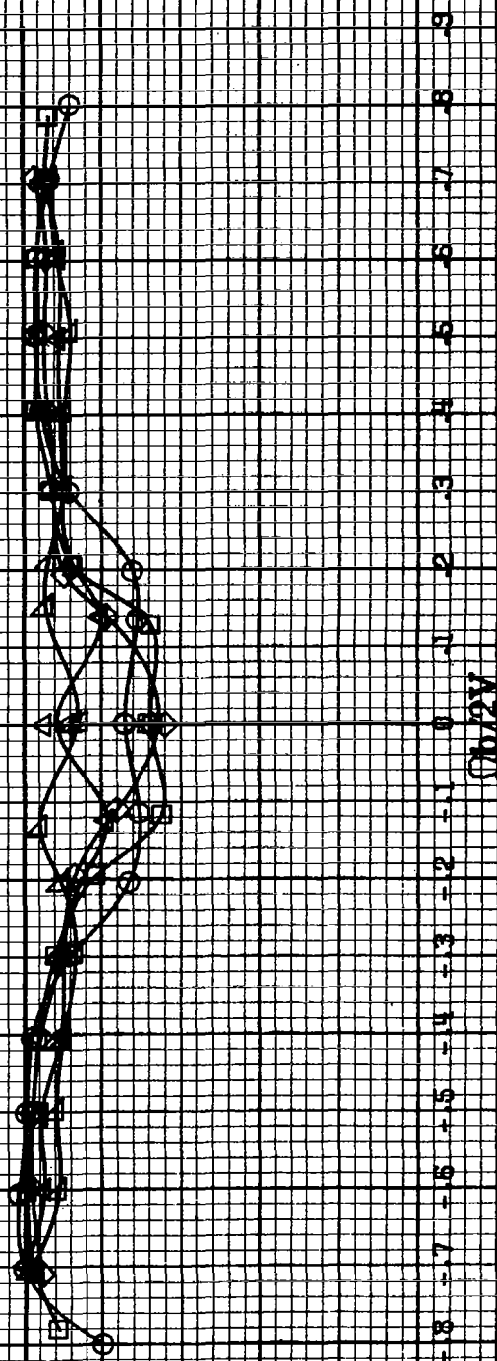
$C_{D,2V}$

(c)  $\mu=30\text{ to }60\text{ deg}$ ,  $SR=0$ .  
 Figure A58-Continued.



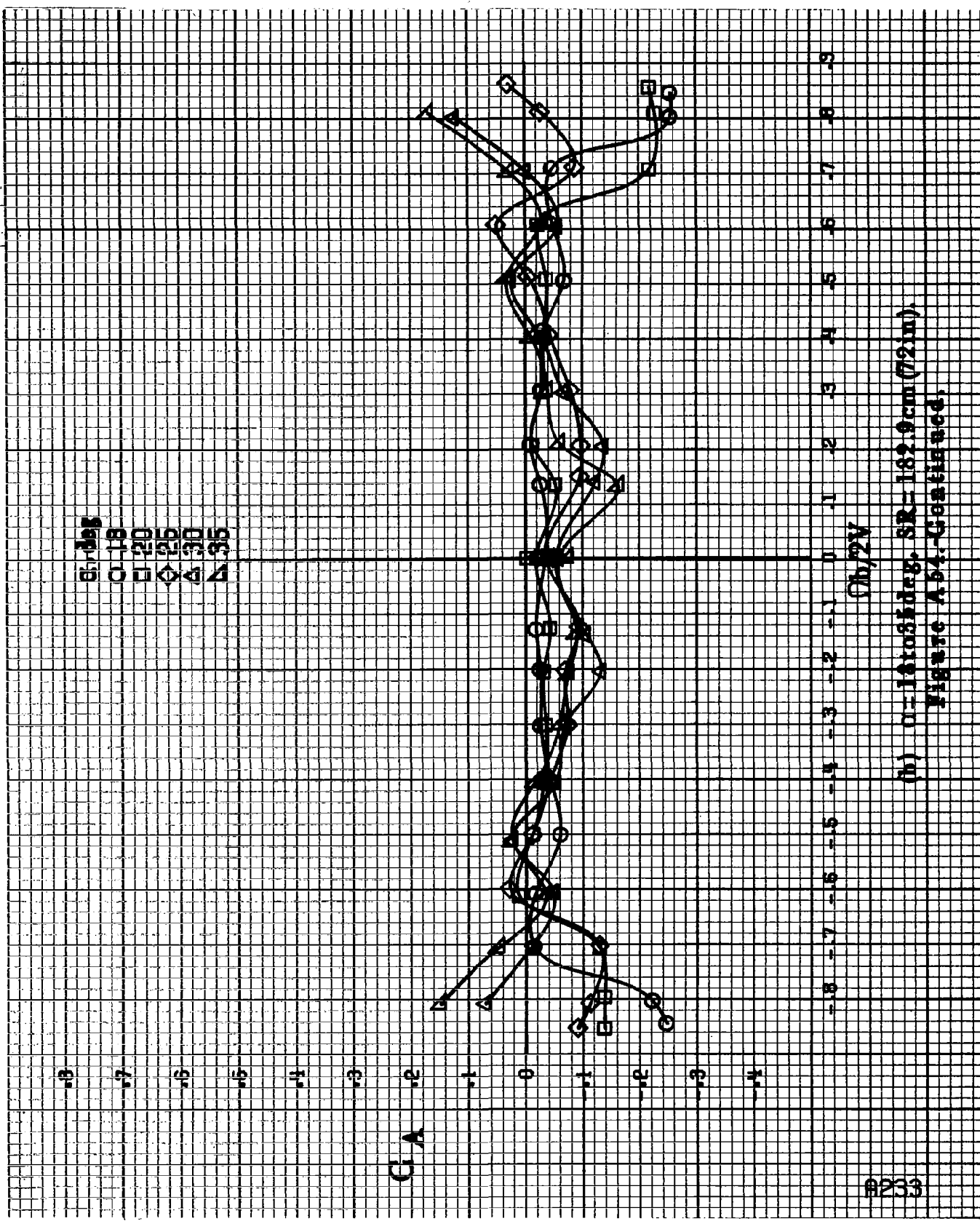


(d)  $\mu = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A58. Concluded.



(e)  $\alpha = 84016 \text{ deg}$ ,  $\beta R = 1.829 \text{ cm}$  (72 in).

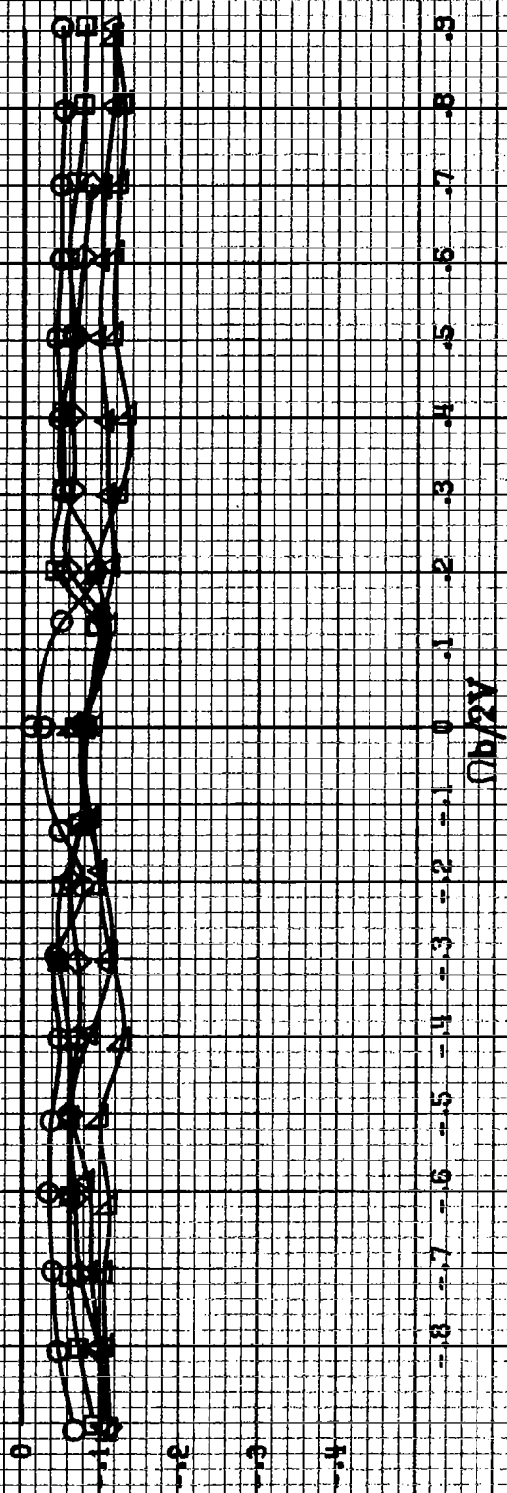
Figure A54. Effect of rotation rate and angle of attack on axis-force coefficient for on-board L.E. wing droop with large nose radius and inboard fairing.  $\phi_1 = 0^\circ$ ,  $\phi_2 = 0^\circ$ ,  $\phi_3 = 0^\circ$ ,  $\phi_4 = 0^\circ$ .



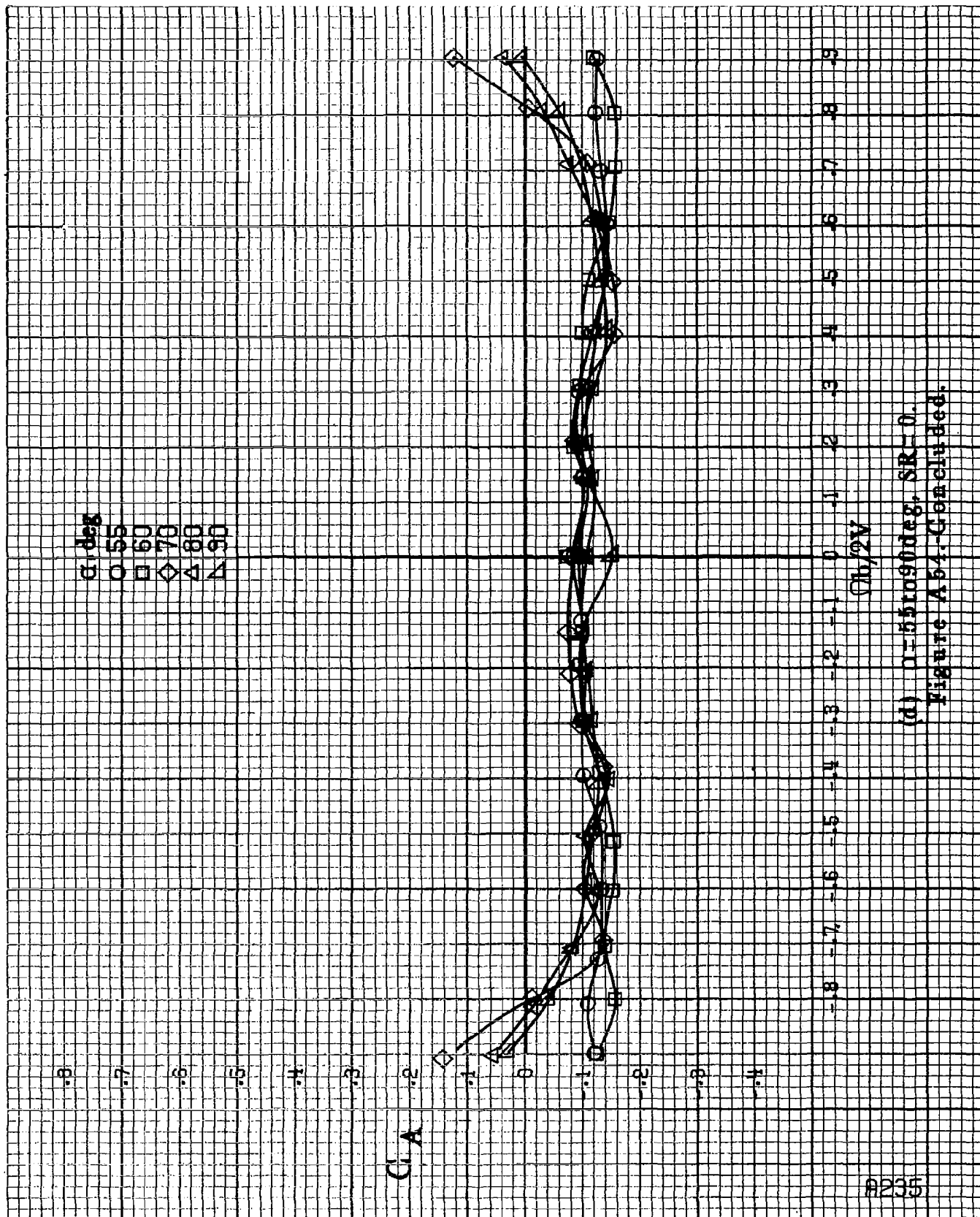
(h)  $\alpha = 14.085 \text{ deg}$ ,  $SR = 182.9 \text{ cm (72 in)}$ ,  
 Figure A 54. Continued.

$\beta$ , deg  
 ○ 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▽ 50

$C_A$



(a)  $\alpha=30$  to  $60$  deg,  $SR=0$ .  
 Figure A54.-Continued.



(d)  $1-55$  to  $90$  deg,  $SR=0$ .  
Figure A54-Continued.

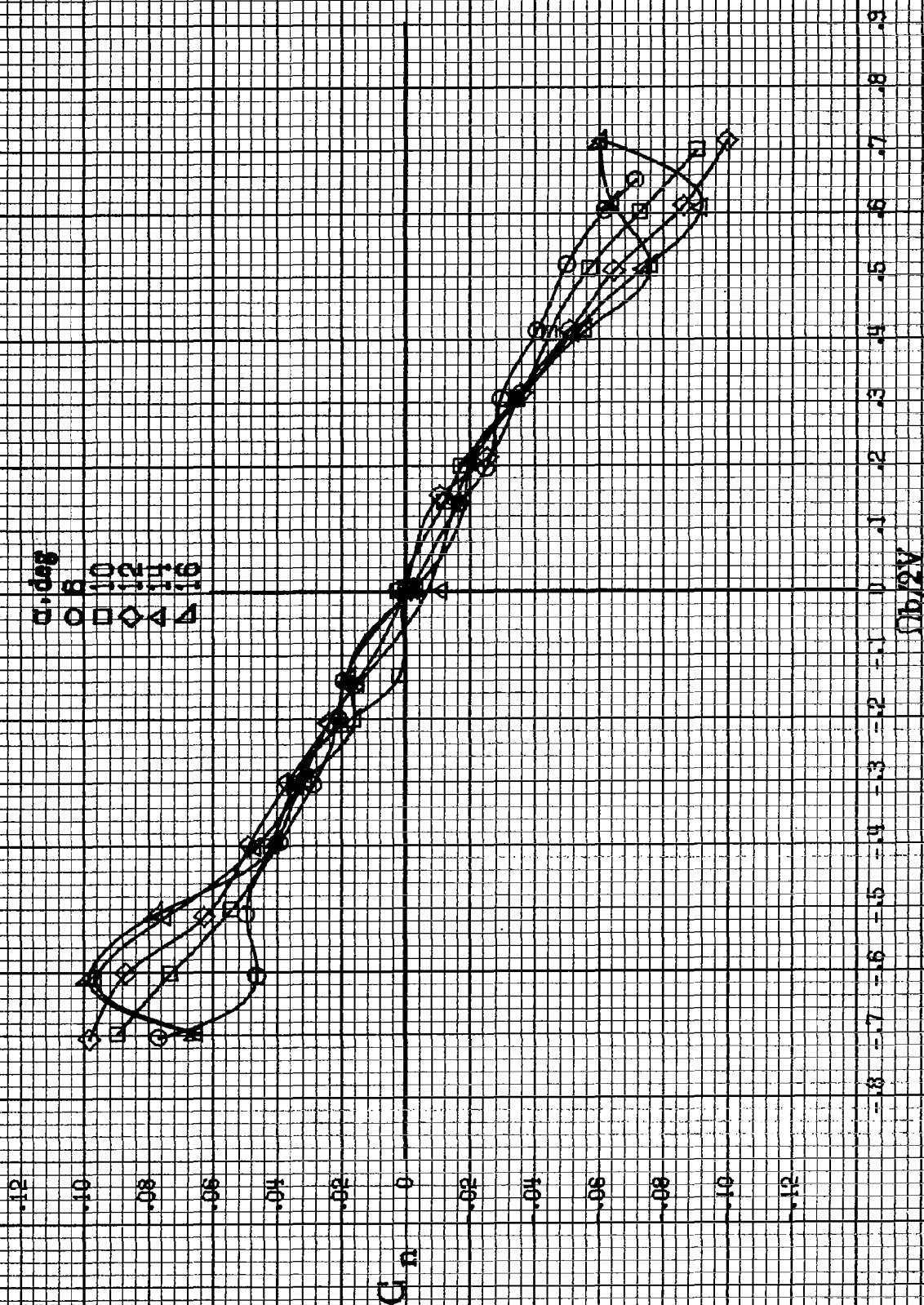
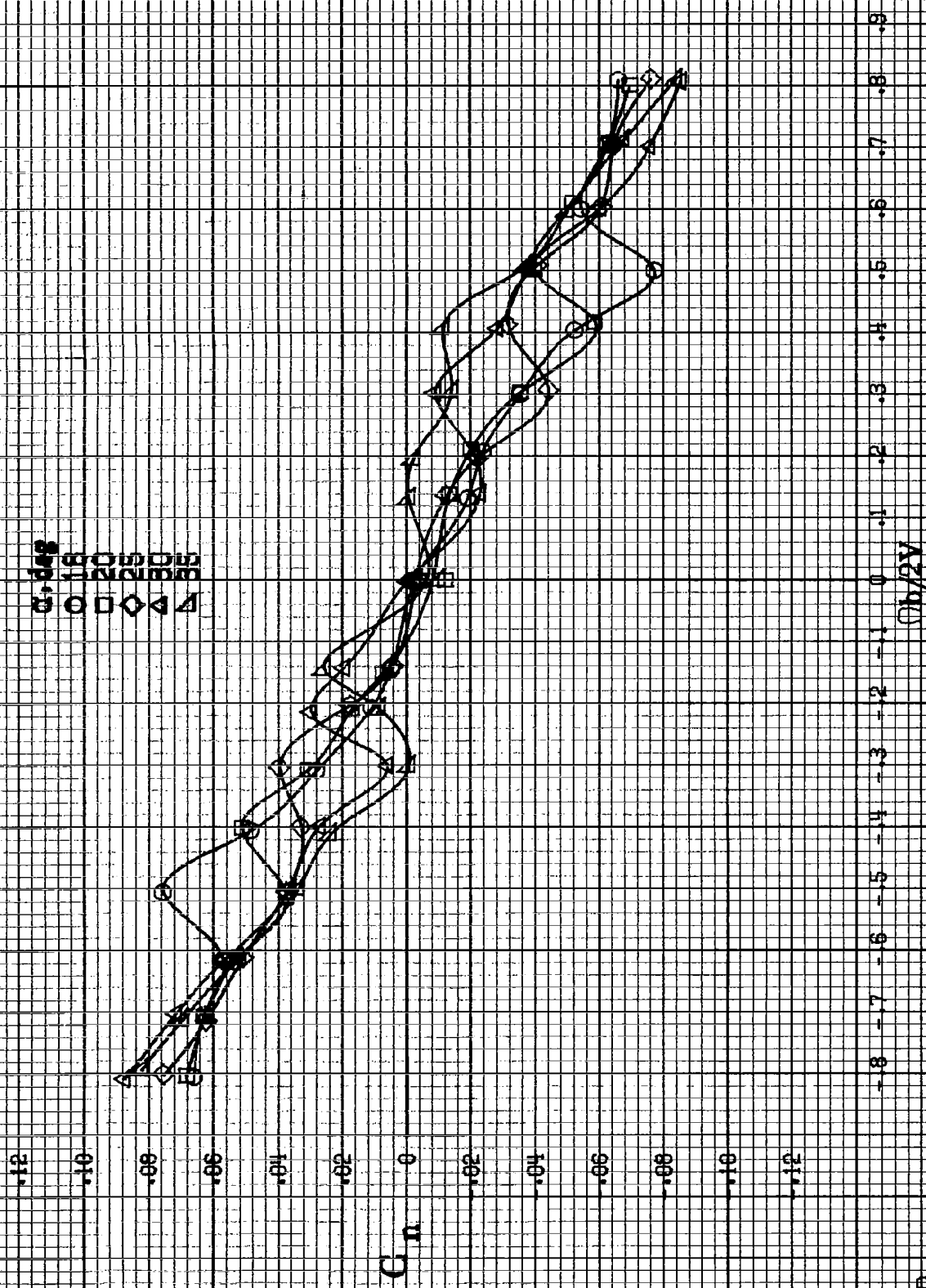


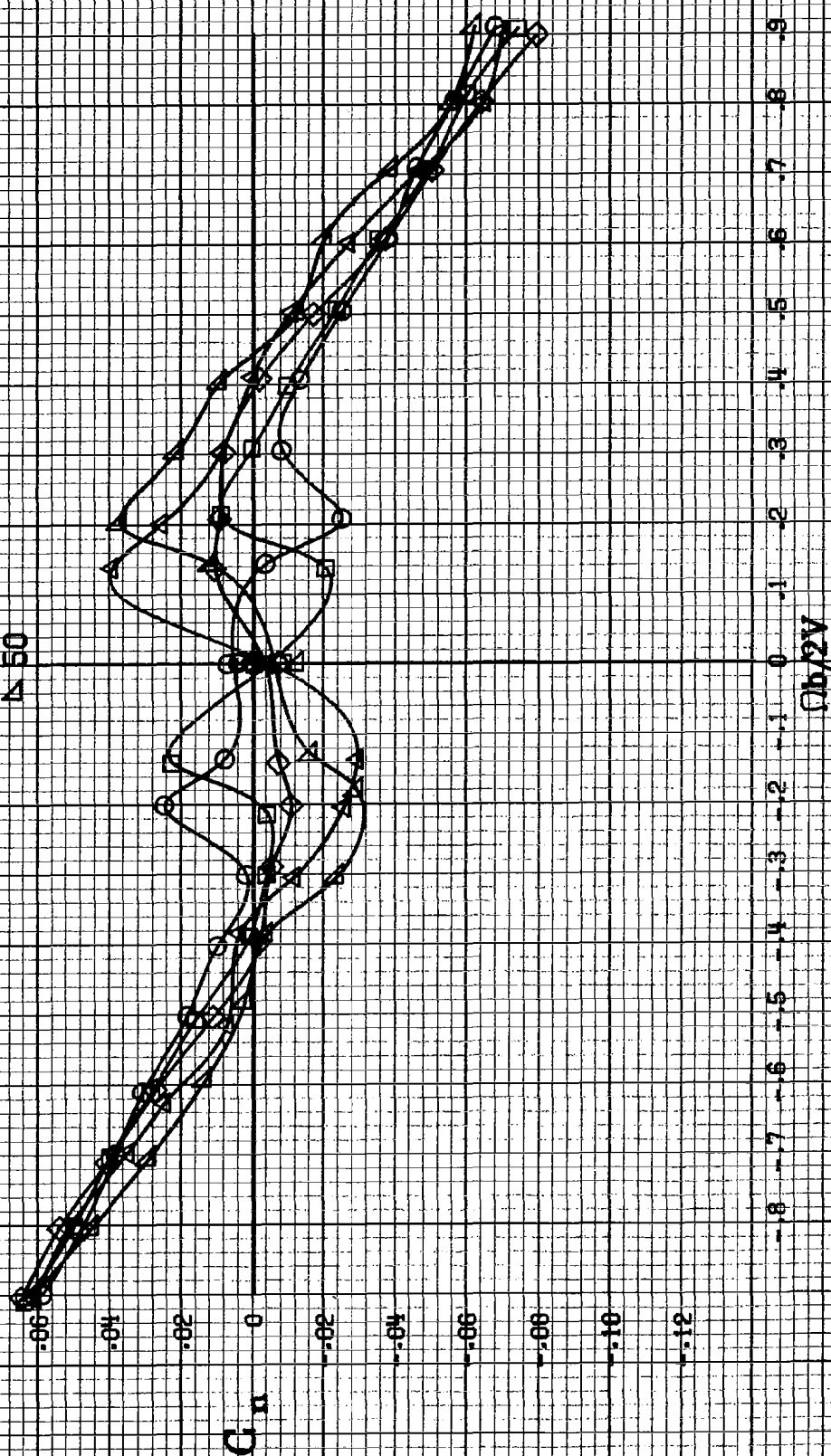
Figure A11. Effect of rotation rate and angle of attack on yawing-moment coefficient for outboard LE wing droop with large nose radius.  $\beta = 0^\circ$ ,  $\delta_n = 0^\circ$ ,  $\delta_r = 0^\circ$ ,  $\delta_l = 0^\circ$ .  $\alpha = 8$  to  $16^\circ$ ,  $SR = 192.9 \text{ cm (72 in.)}$ .





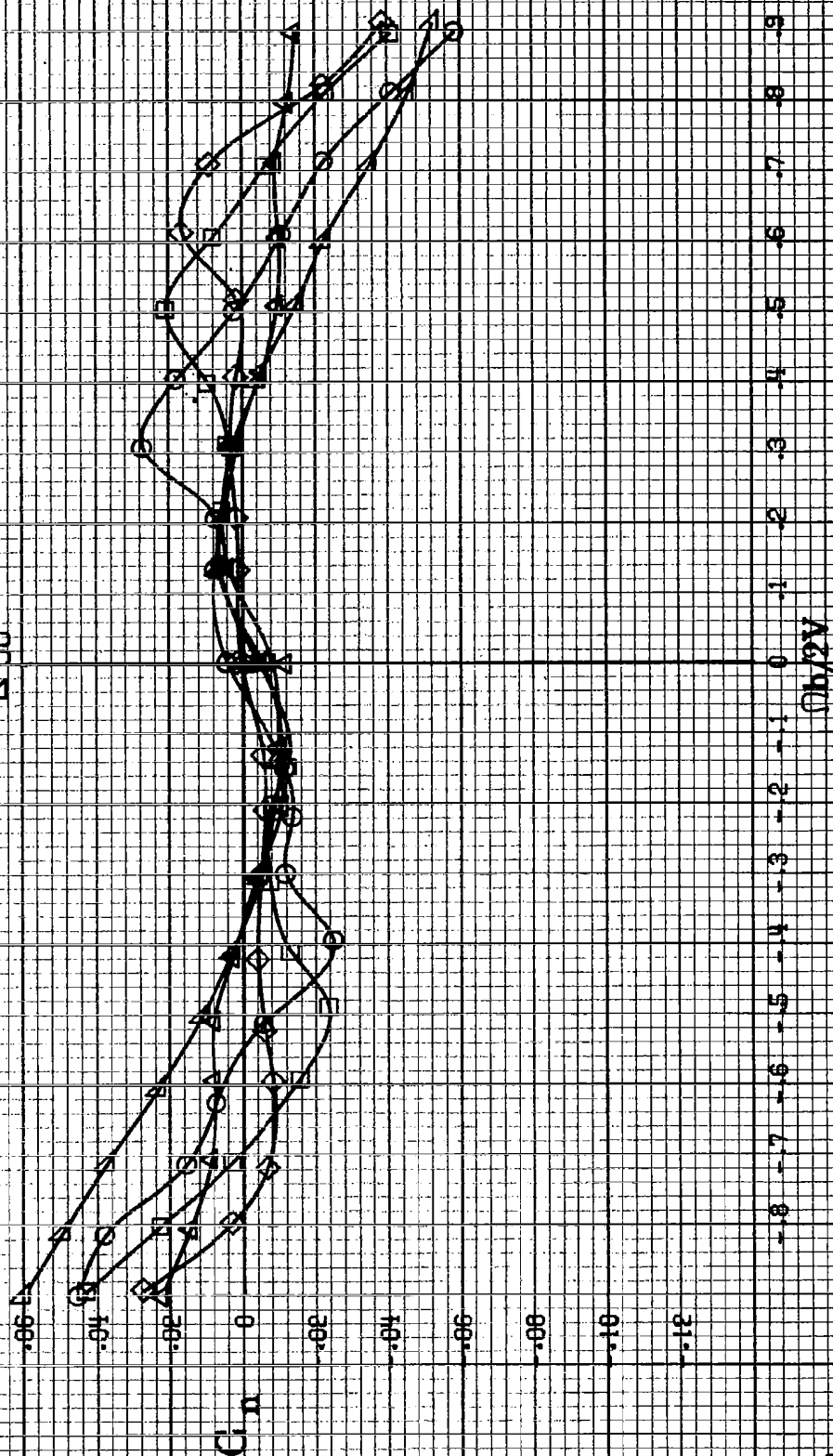
(b)  $\alpha = 18$  to  $35$  deg,  $SR = 182.9$  cm (72 in).  
Figure A65.-Continued.

$\alpha, \text{deg}$   
 30  
 35  
 40  
 45  
 50



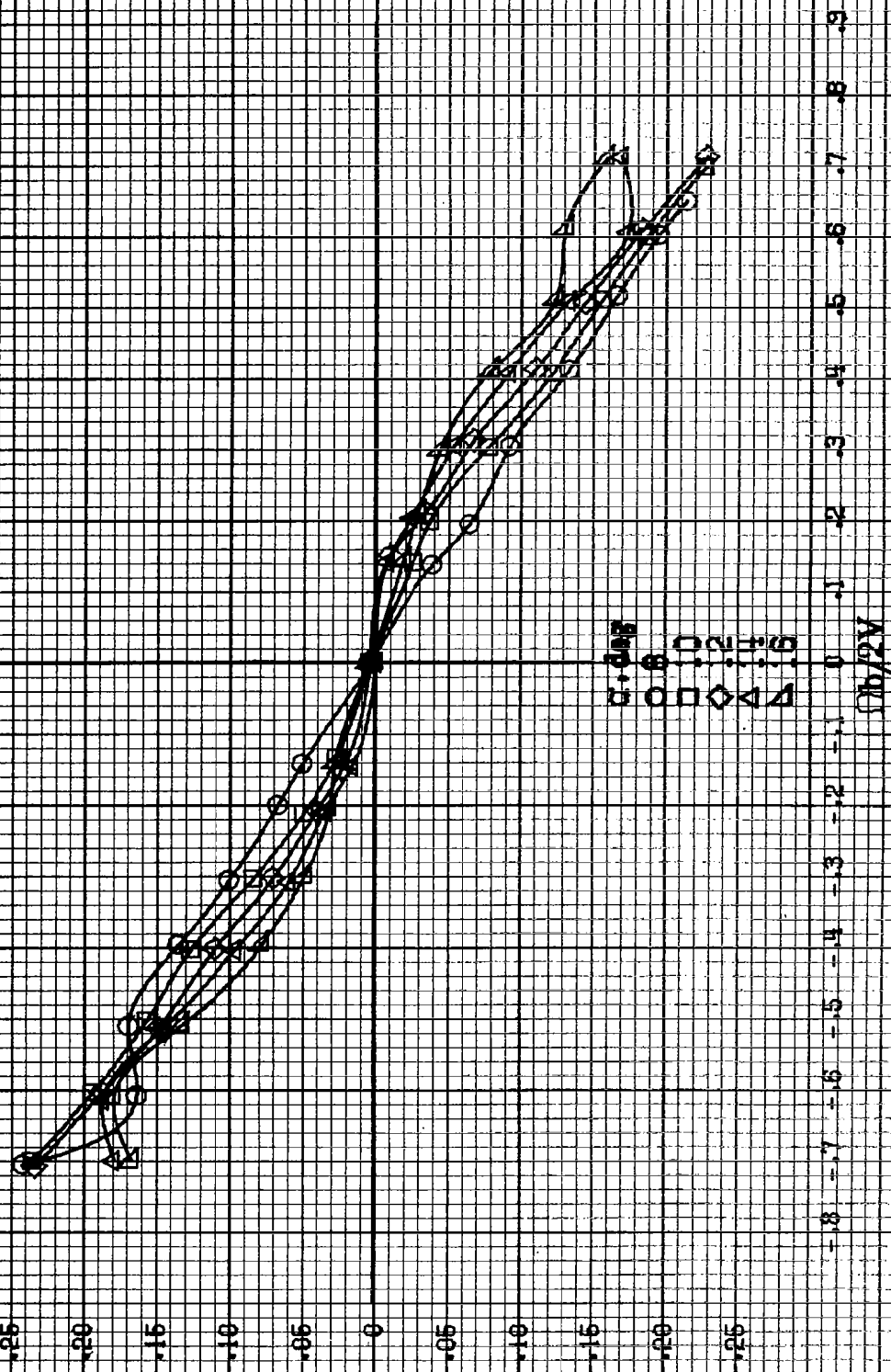
(c)  $\alpha = 30$  to  $50^\circ$ ,  $SR = 0$ .  
 Figure A55.-Continued.

$\alpha$ , deg  
 ○ 55  
 □ 60  
 ◇ 70  
 △ 80  
 ▲ 90



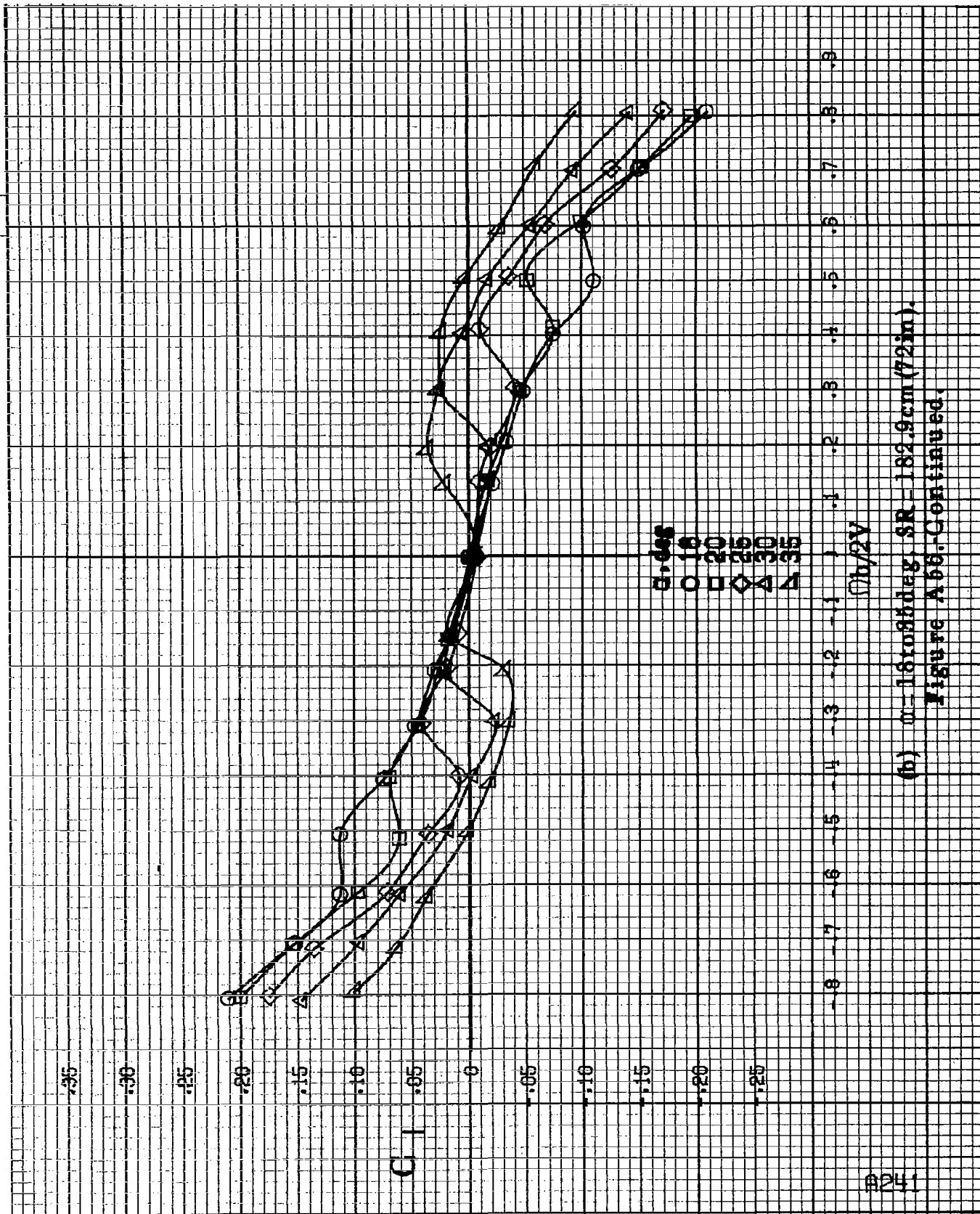
(d)  $\alpha = 55$  to  $90$  deg,  $SR = 0$ .  
 Figure A55-Continued.

$C_L$

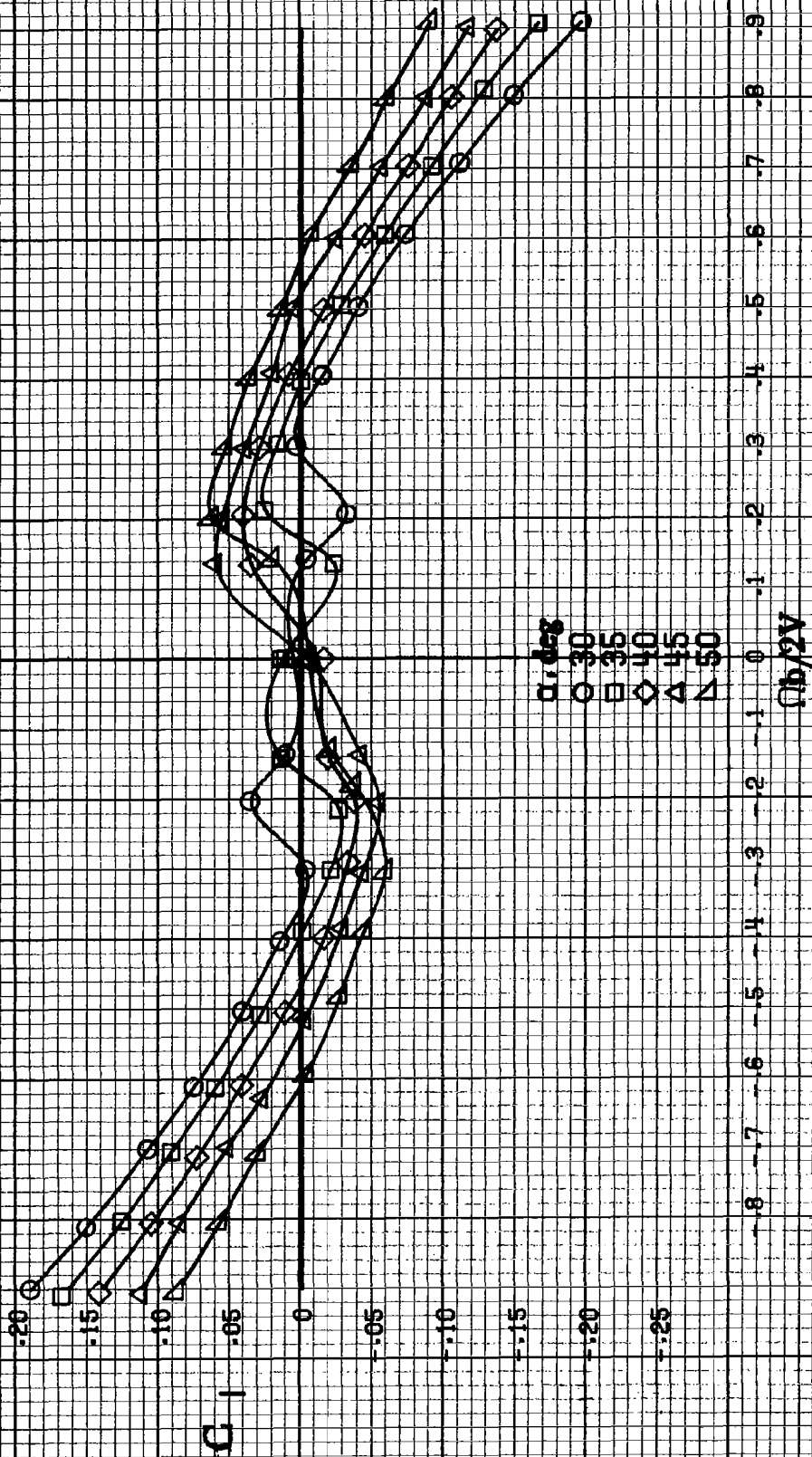


(a)  $\alpha = 8$  to  $16$  deg,  $SR = 132.8$  cm (72 in).

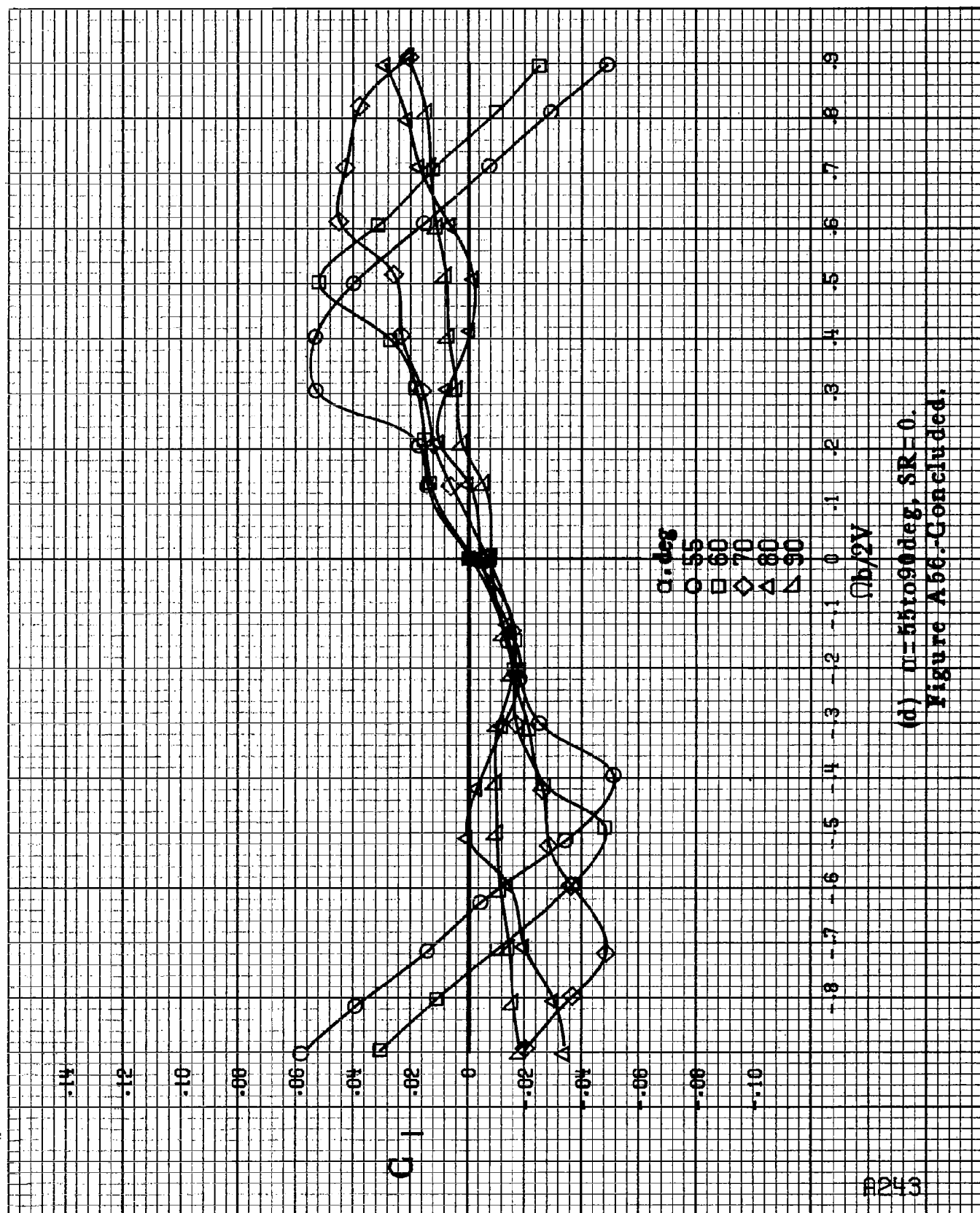
Figure A58.-Effect of rotation rate and angle of attack on rolling-moment coefficient for outboard L.E. wing droop with large nose radius.  $\delta_a = 0^\circ$ ,  $\delta_r = 0^\circ$ ,  $\delta = 0^\circ$ .



(b)  $m=16$  to  $35$  deg,  $SR=182.9\text{cm}$  (72 in).  
Figure A66-Continued.



(c)  $\alpha = 30$  to  $50$  deg,  $SR = 0$ .  
Figure A66.-Continued.



(d)  $\mu = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A56.-Concluded.

8244

$C_m$

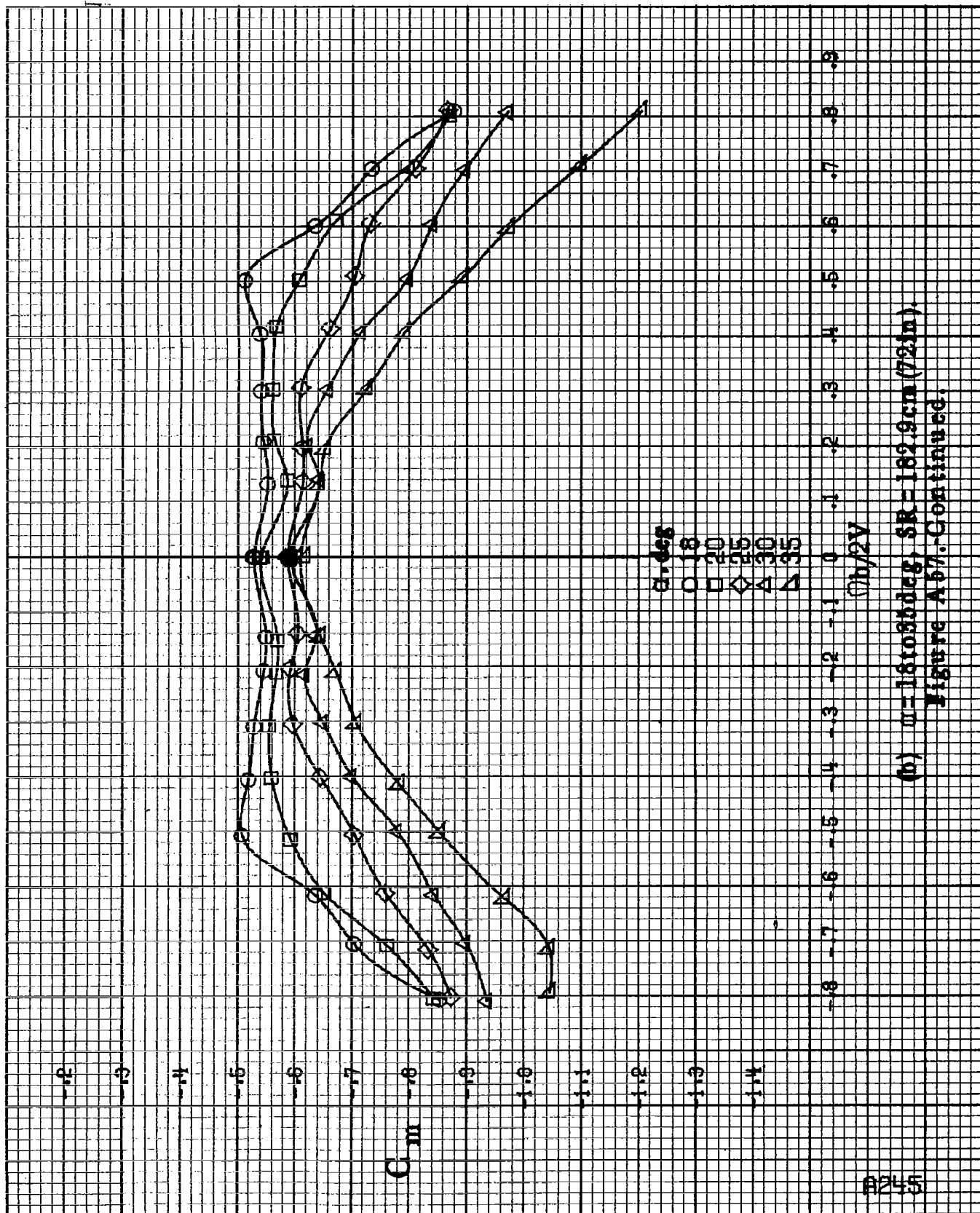
$\alpha, \text{deg}$   
 8  
 10  
 12  
 14  
 16

$b/2V$

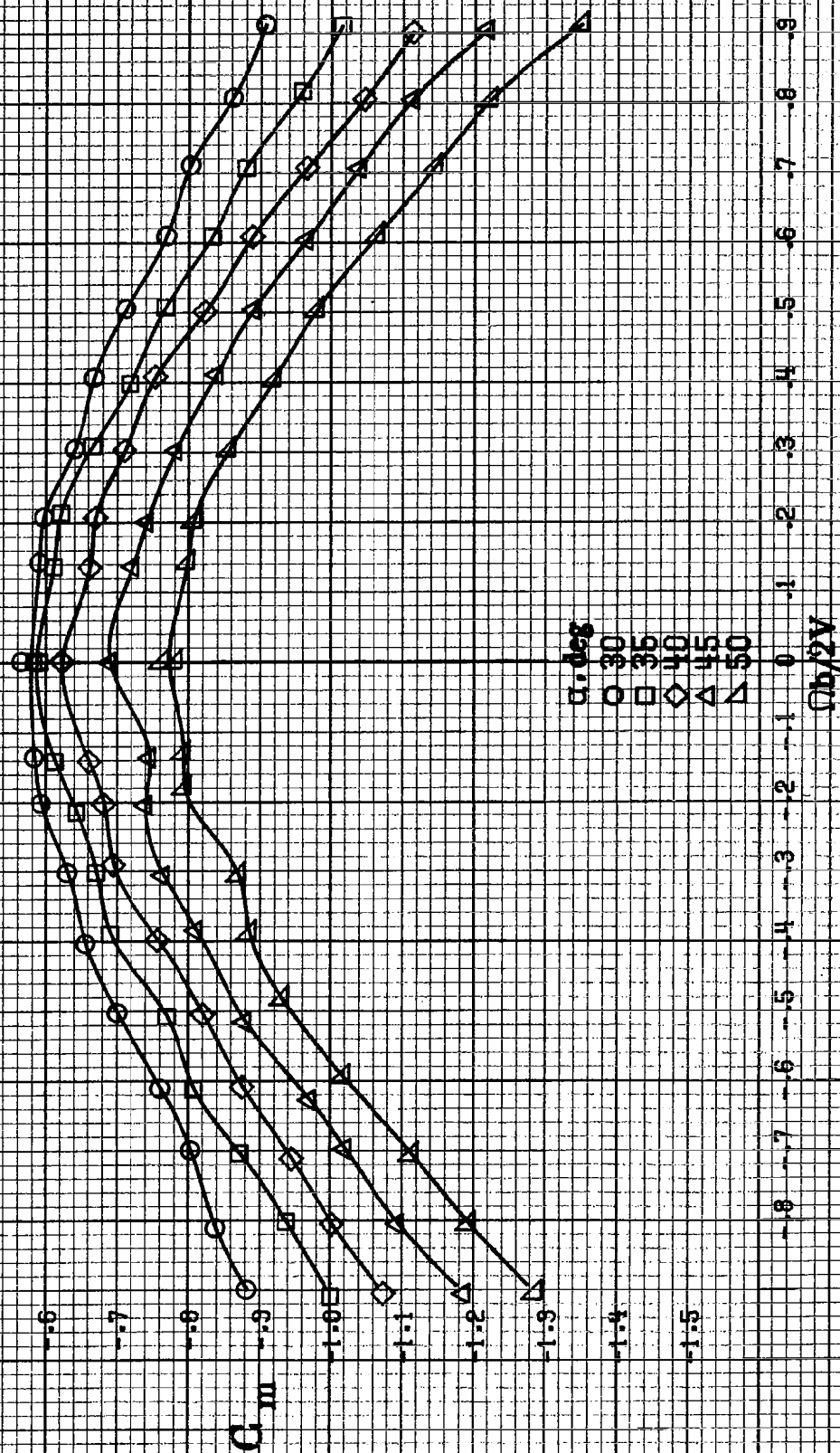
(a)  $\alpha = 8$  to  $16$  deg,  $SR = 132.9 \text{ cm} (72 \text{ in})$ .

Figure A67.-Effect of rotation rate and angle of attack on pitching-moment coefficient for outboard LE wing droop with large nose radius.  $\delta_n = 0^\circ$ ,  $\delta_a = 0^\circ$ ,  $\delta_r = 0^\circ$ .

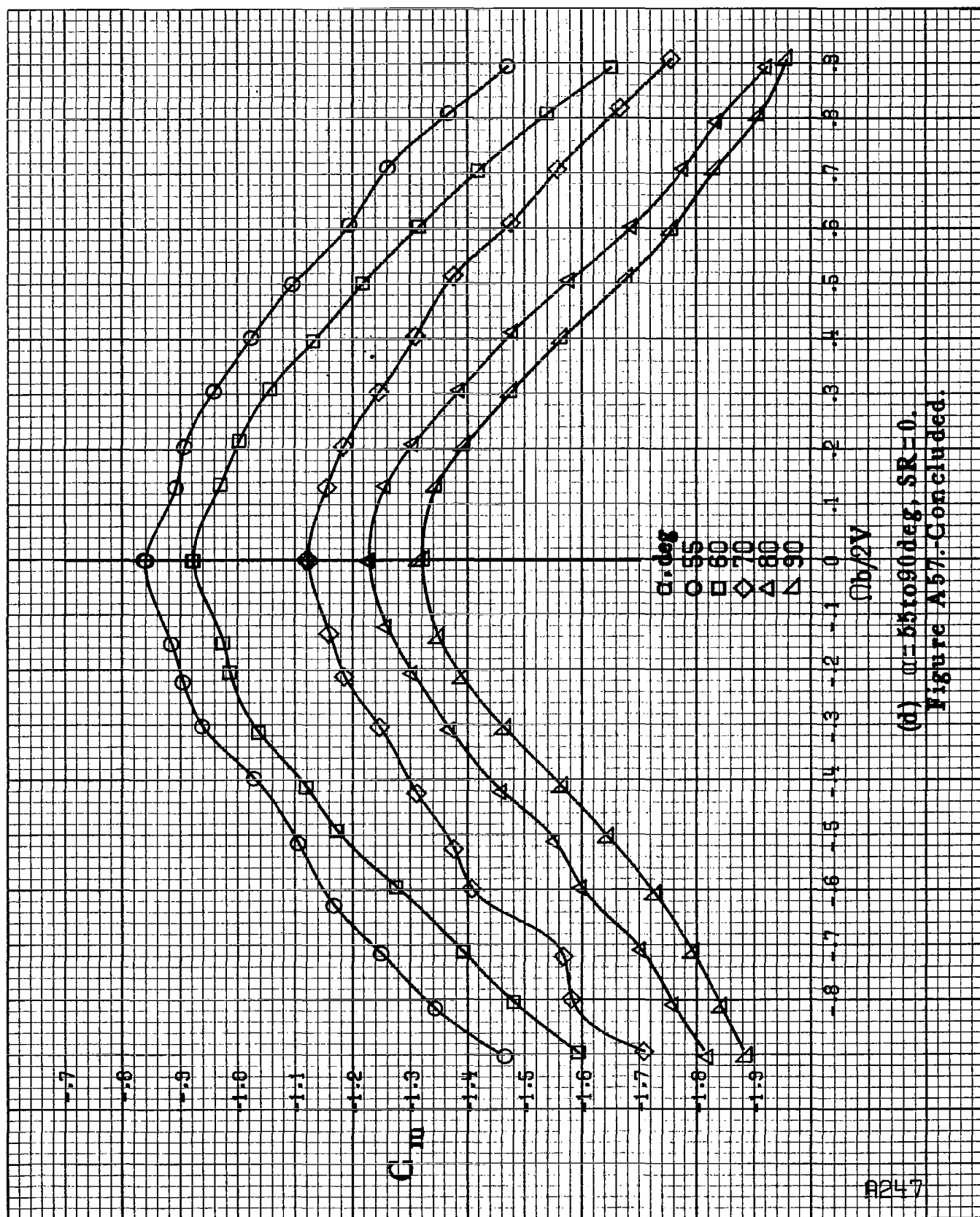




(b)  $m=181085\text{deg}$ ,  $SR=182.9\text{cm}$  (72in).  
Figure A57.-Continued.



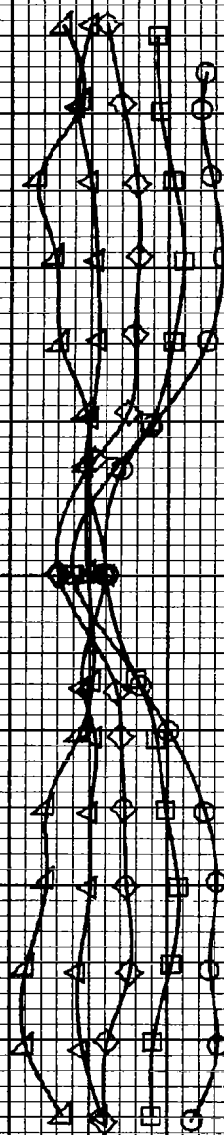
(c)  $\alpha = 30$  to  $50^\circ$ ,  $SR = 0$ .  
Figure A57-Continued.



(d)  $\mu = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A57: Concluded.

$\alpha$ , deg  
 $\alpha = 0^\circ$   
 $\alpha = 1^\circ$   
 $\alpha = 2^\circ$   
 $\alpha = 3^\circ$   
 $\alpha = 4^\circ$

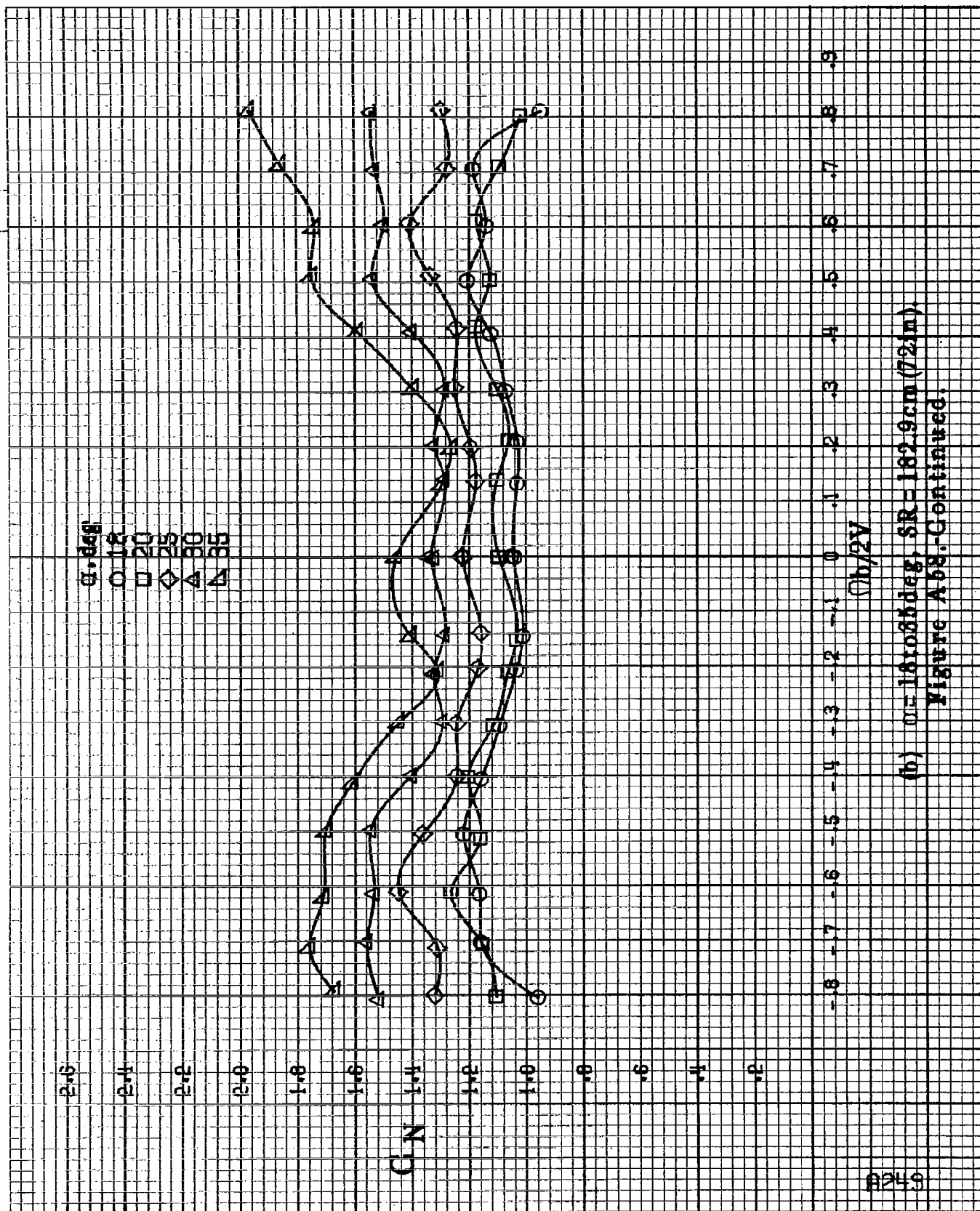
CN



Ob/2V

(a)  $\alpha = 84.16^\circ$ , SR = 182.8 cm (72 in).

Figure A58. Effect of rotation rate and angle of attack on normal-force coefficient for outboard 1/2 wing droop with large nose radius.  $\delta_n = 0^\circ$ ,  $\delta_r = 0^\circ$ ,  $\beta = 0^\circ$ .



(b)  $\alpha = 18$  to  $40^\circ$ ,  $SR = 182.9 \text{ cm (72 in.)}$ .  
Figure A58. Continued.

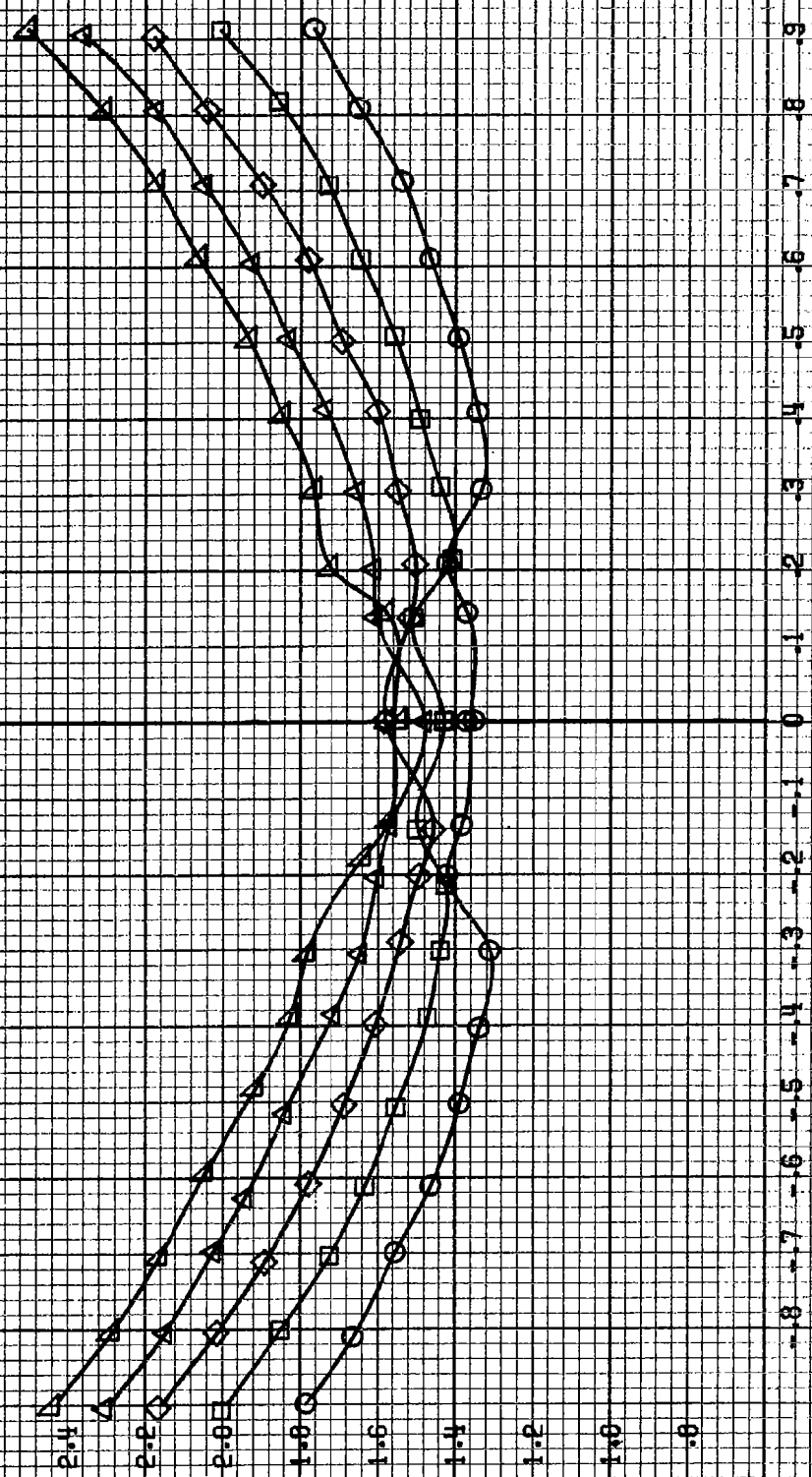
#250

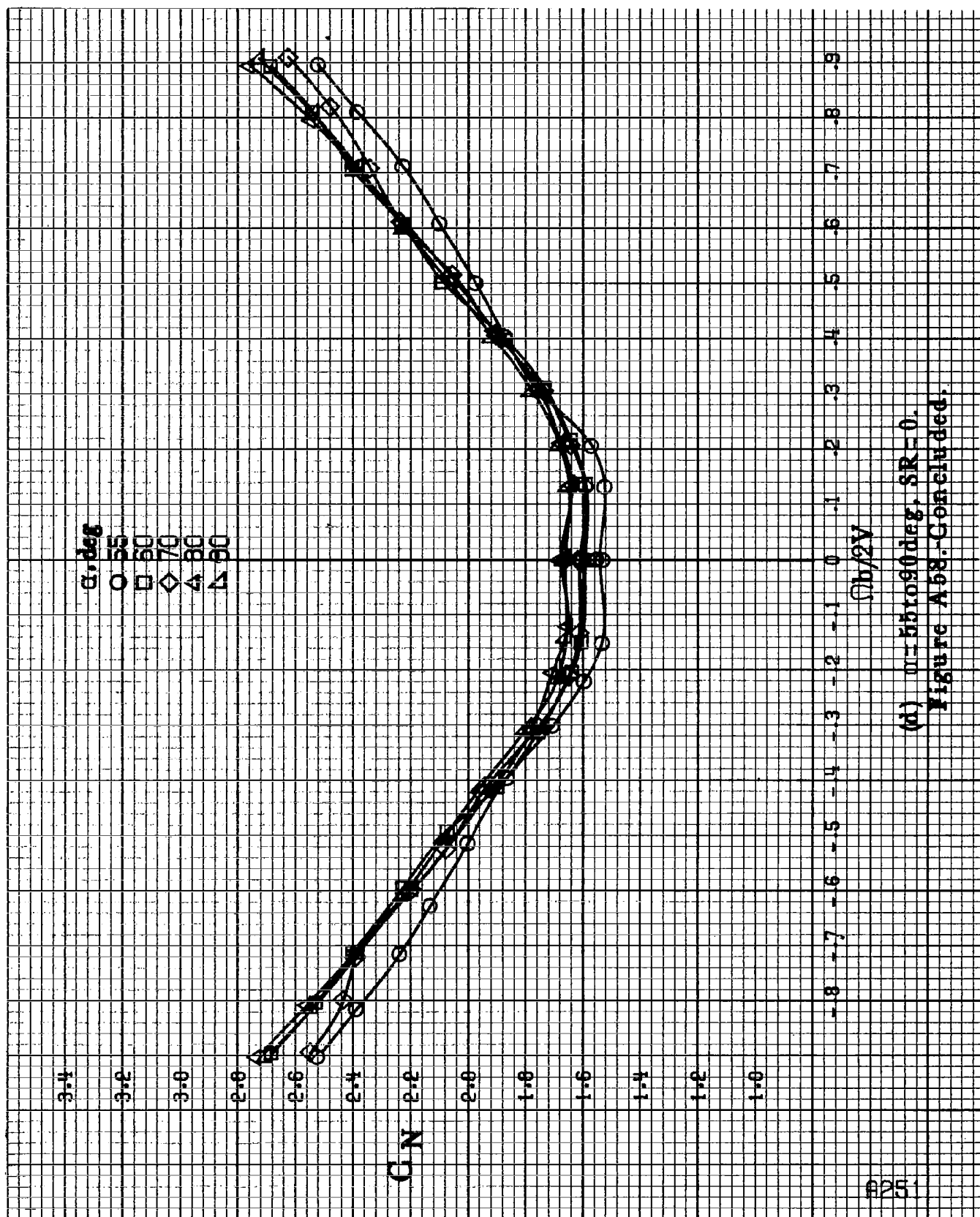
$\alpha, \text{deg}$   
 ○ 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▴ 50

C.N

$\Omega b/2V$

(c)  $\mu = 30$  to  $50 \text{ deg}$ ,  $SR = 0$ .  
 Figure A68.-Continued.





(d)  $\alpha=55$  to  $90^\circ$ ,  $SR=0$ .  
Figure A58. Concluded.

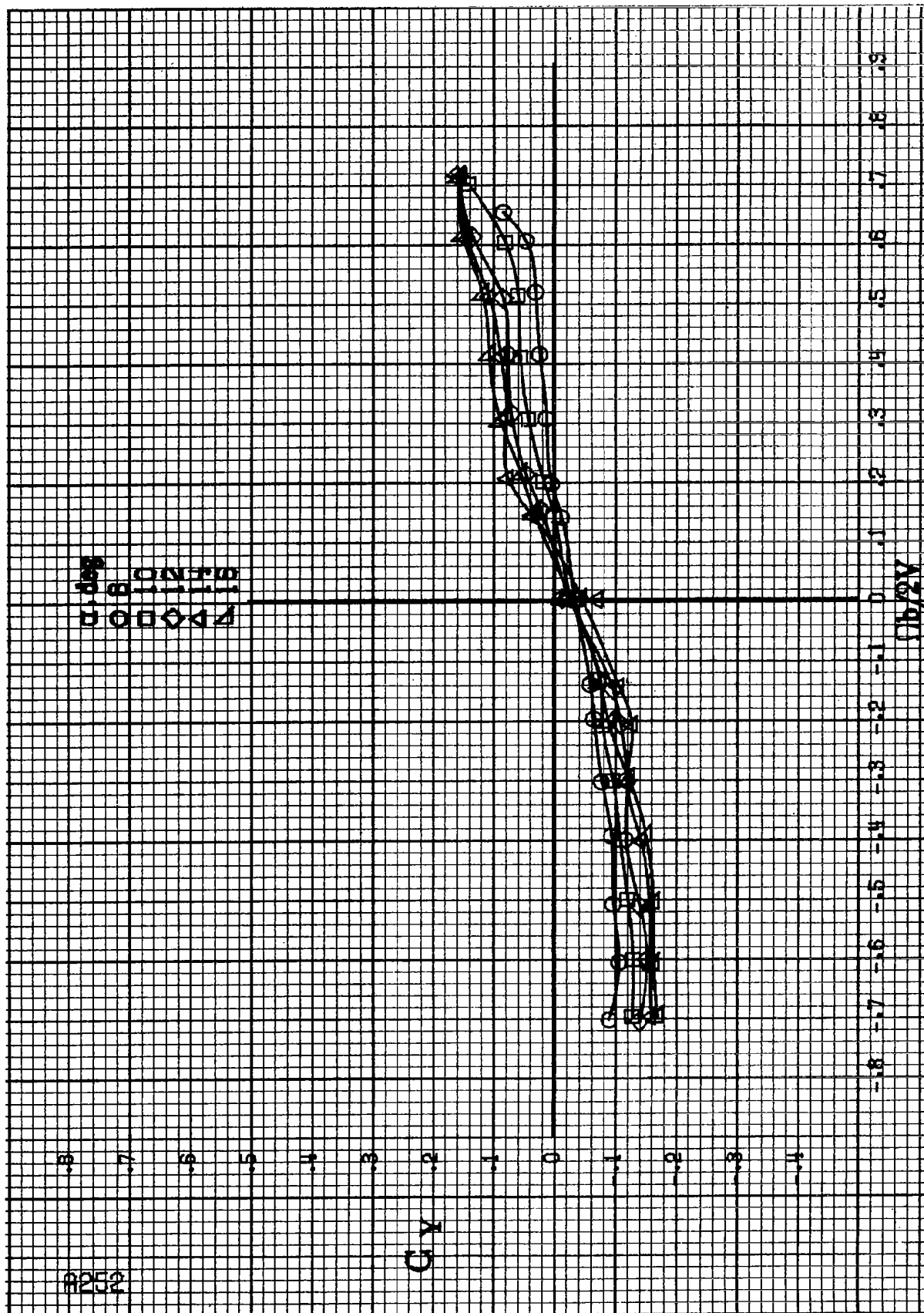
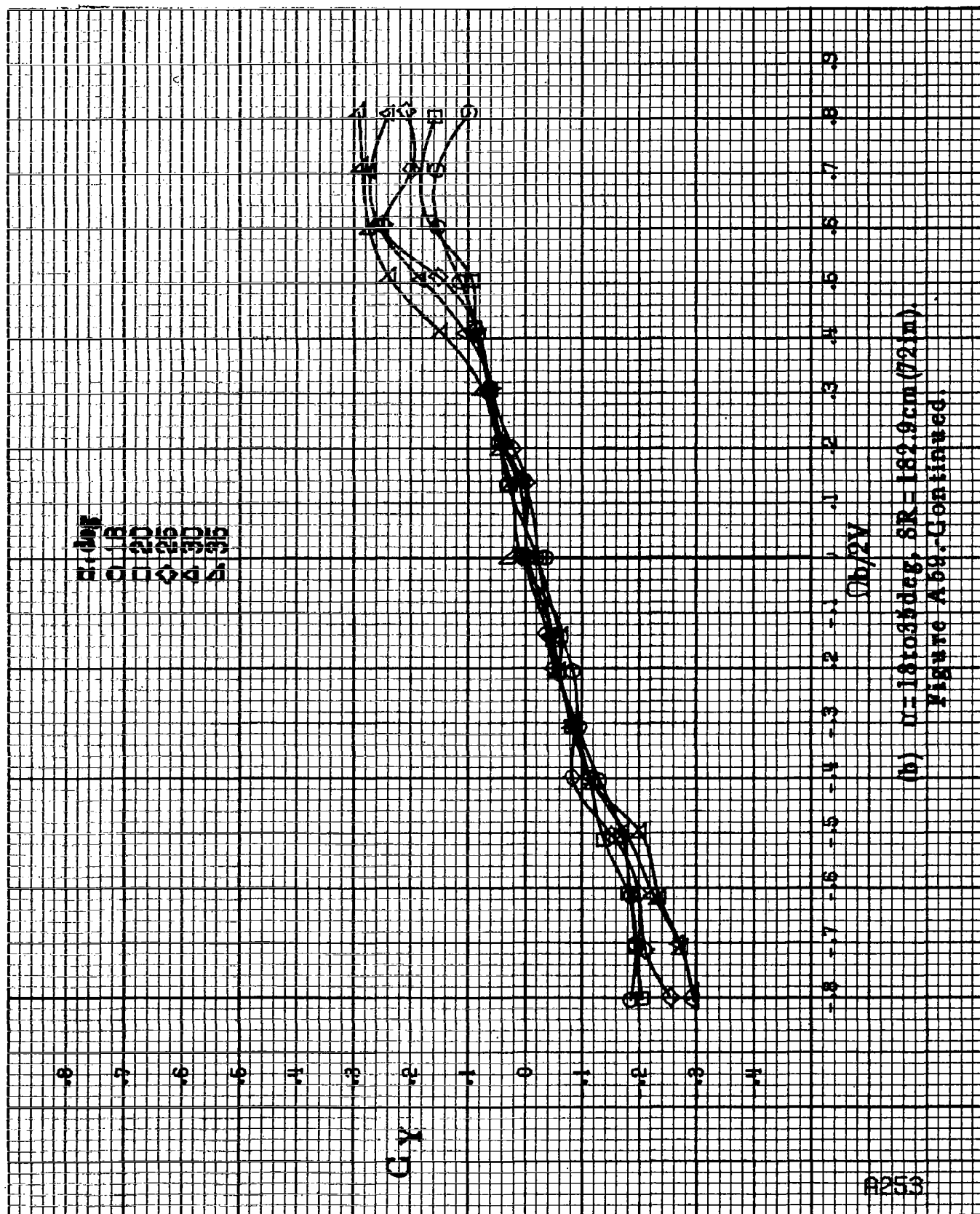


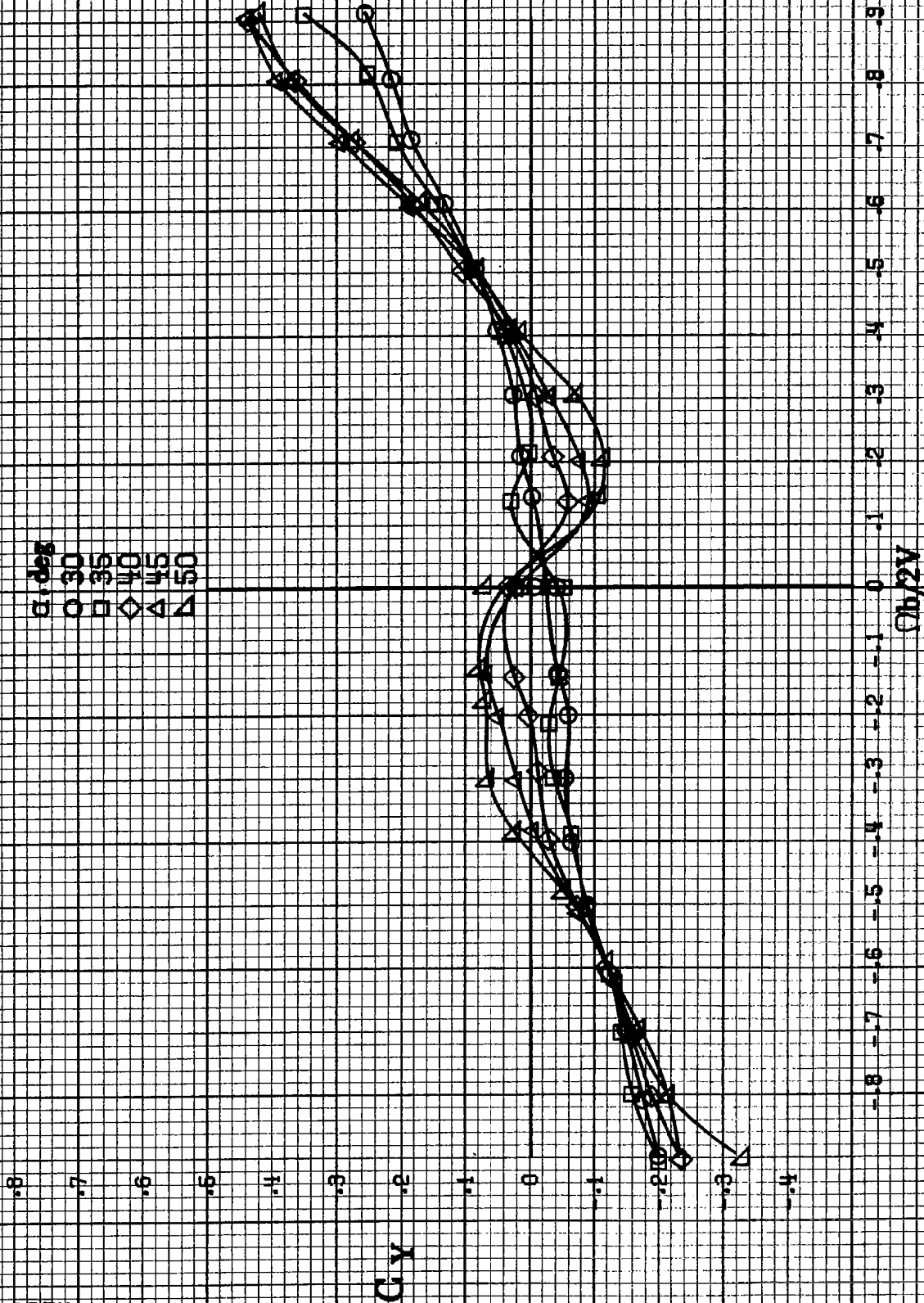
Figure A69.-Effect of rotation rate and angle of attack on side-force coefficient for outboard L2 wing droop with large nose radius.  $\delta_1 = 0^\circ$ ,  $\delta_2 = 0^\circ$ ,  $\delta_3 = 0^\circ$ .



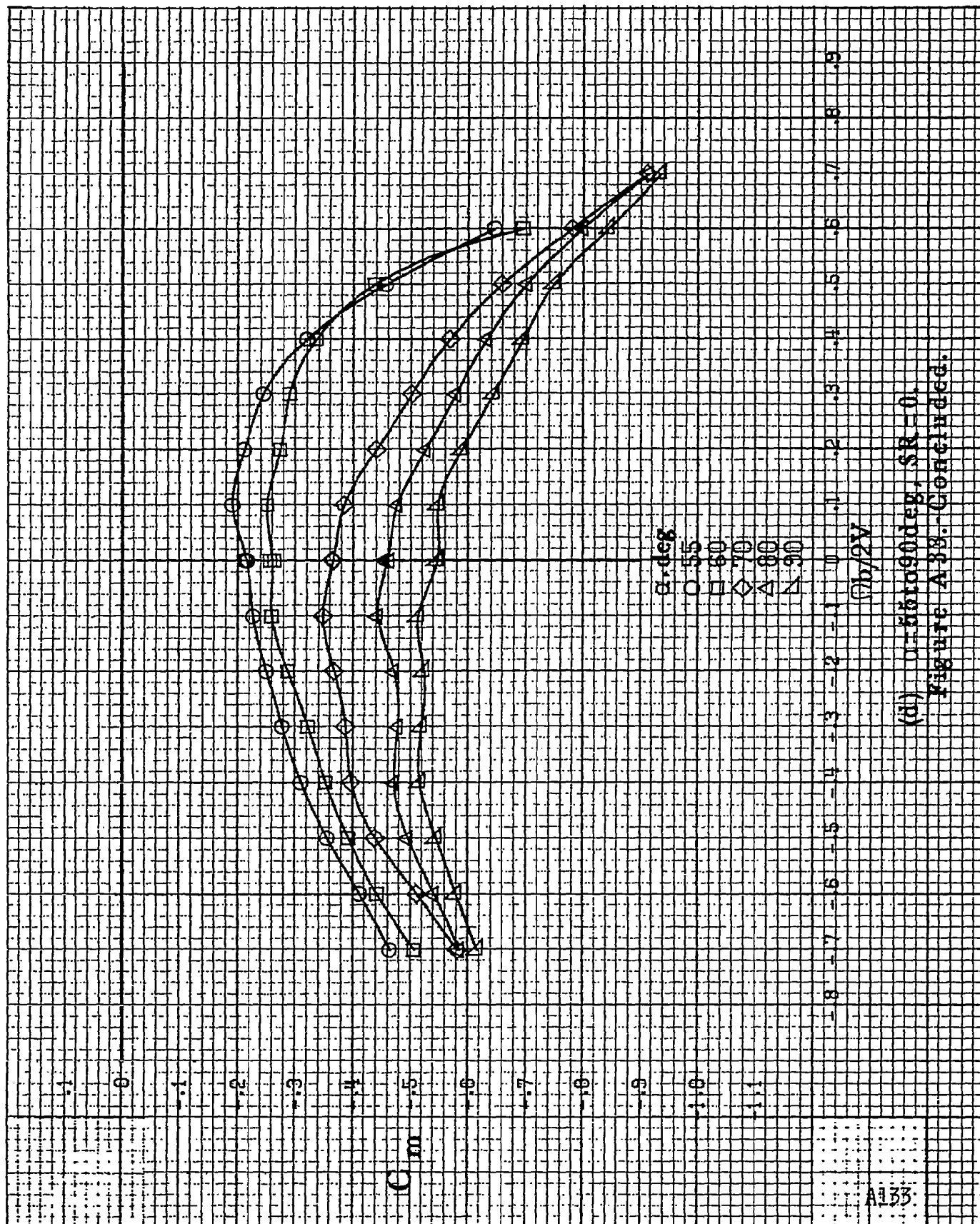


(b)  $n=18034$ deg,  $SR=182.9$ cm (72in).  
Figure A59.-Continued.

A254



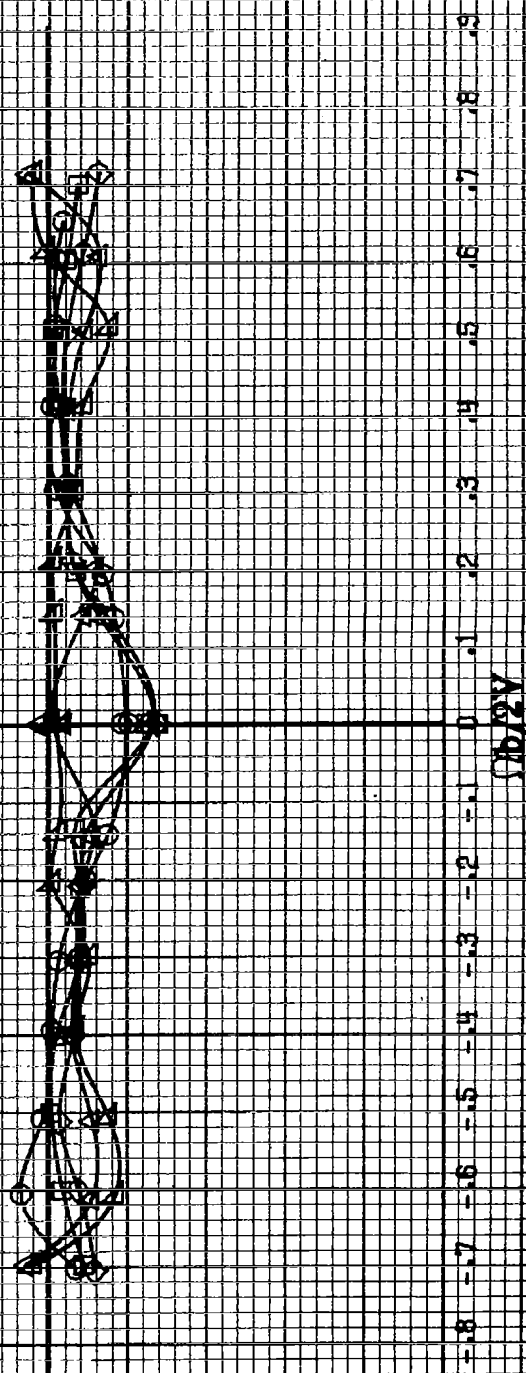
(c)  $\alpha = 30$  to  $50^\circ$ ,  $SR = 0$ .  
Figure A59-Continued.



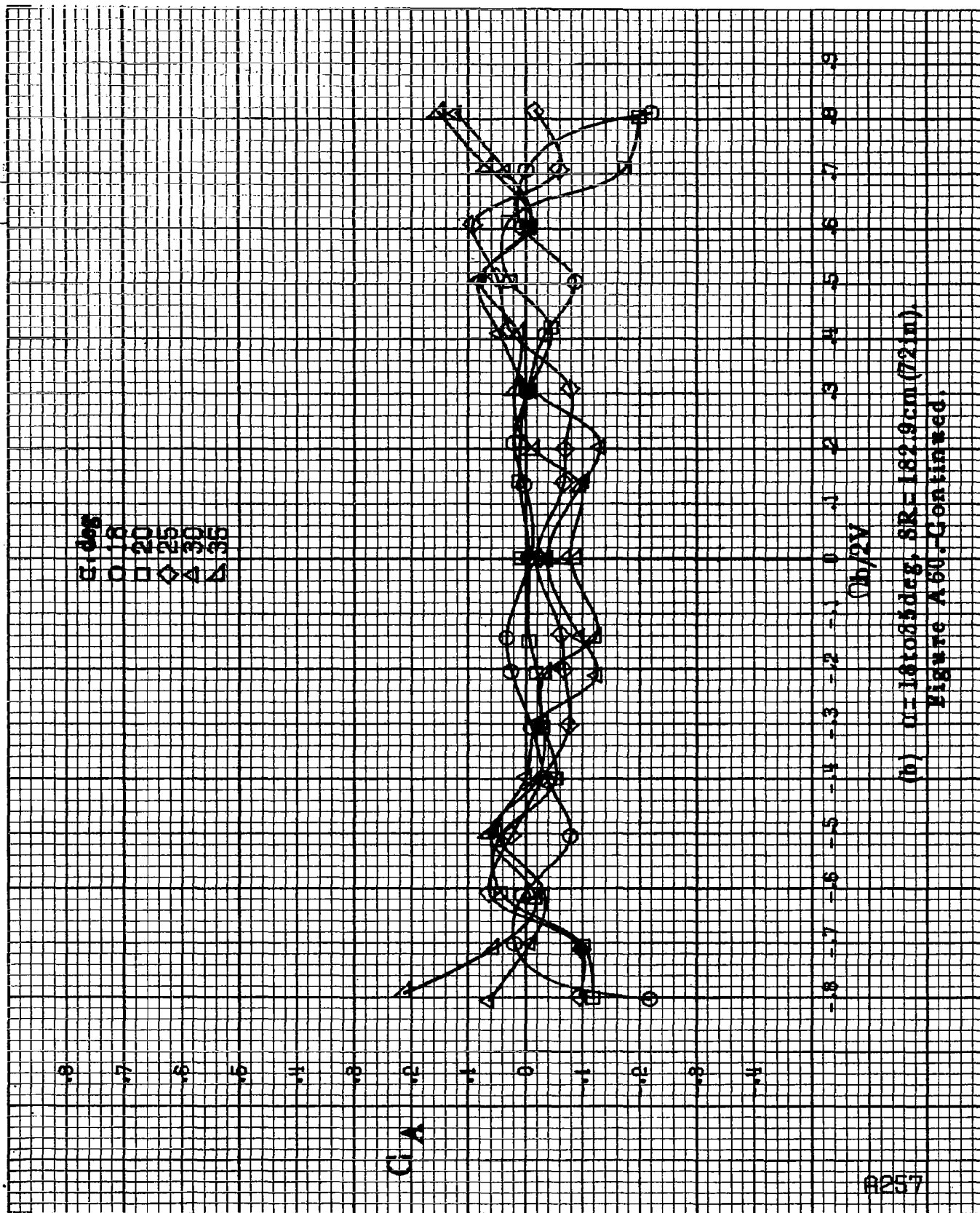
(d)  $U=55$  to  $90^\circ$ ,  $SR=0$ .  
Figure A-33. Continued.

u, deg  
0 1 2 3 4 5 6 7 8

C<sub>A</sub>



(a)  $\alpha = 8 \pm 16 \text{ deg}$ ,  $SR = 182.9 \text{ cm (72 in.)}$ .  
Figure A60. Effect of rotation rate and angle of attack on axial force coefficient for outboard LE wing droop with large cone radius.  $\delta_1 = 0^\circ$ ,  $\delta_2 = 0^\circ$ ,  $\delta_3 = 0^\circ$ .



(b)  $\mu = 1.6 \times 10^{10} \text{ deg}$ ,  $SR = 1.62.9 \text{ cm (72 in)}$ .  
Figure A60.-Continued.

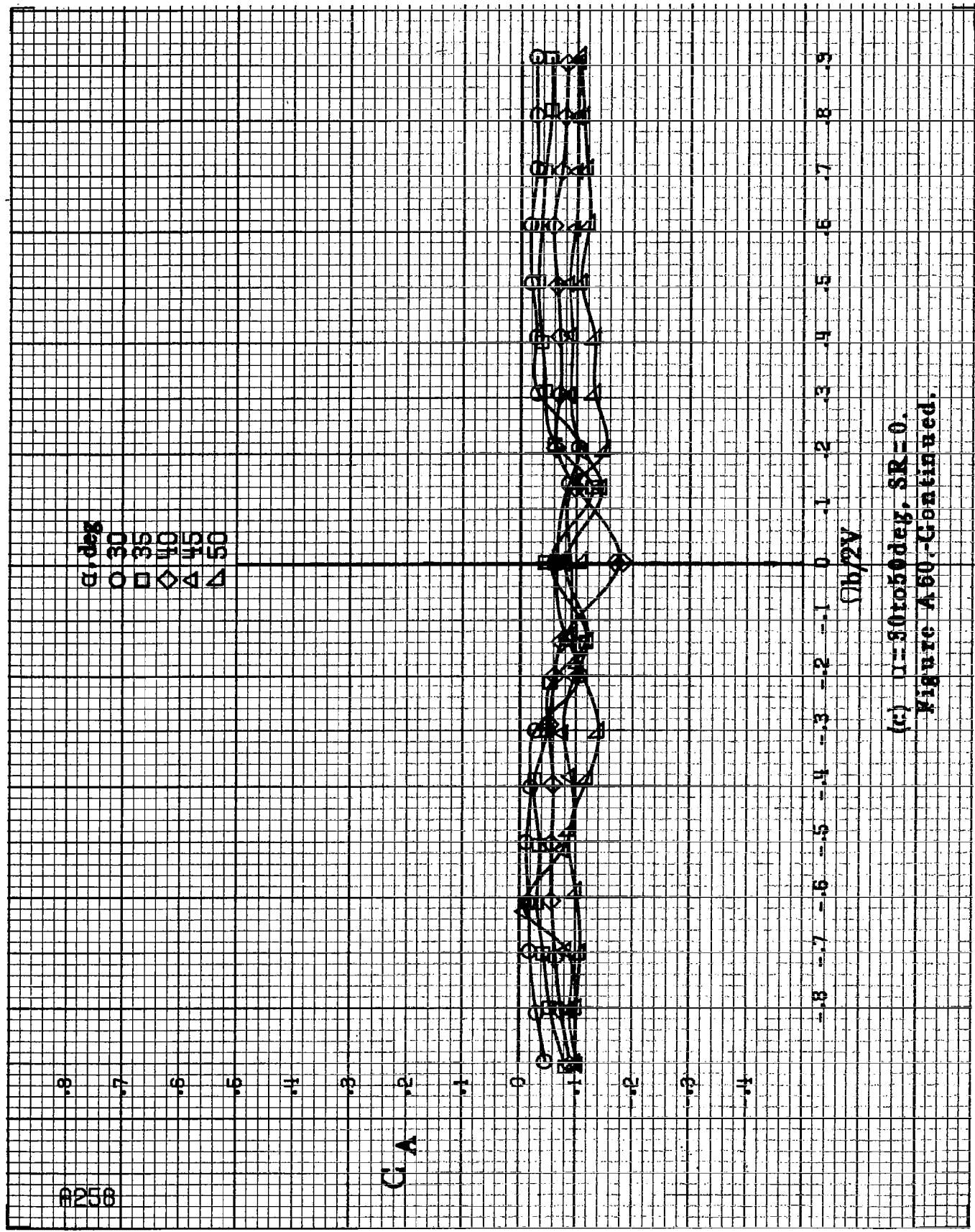
#258

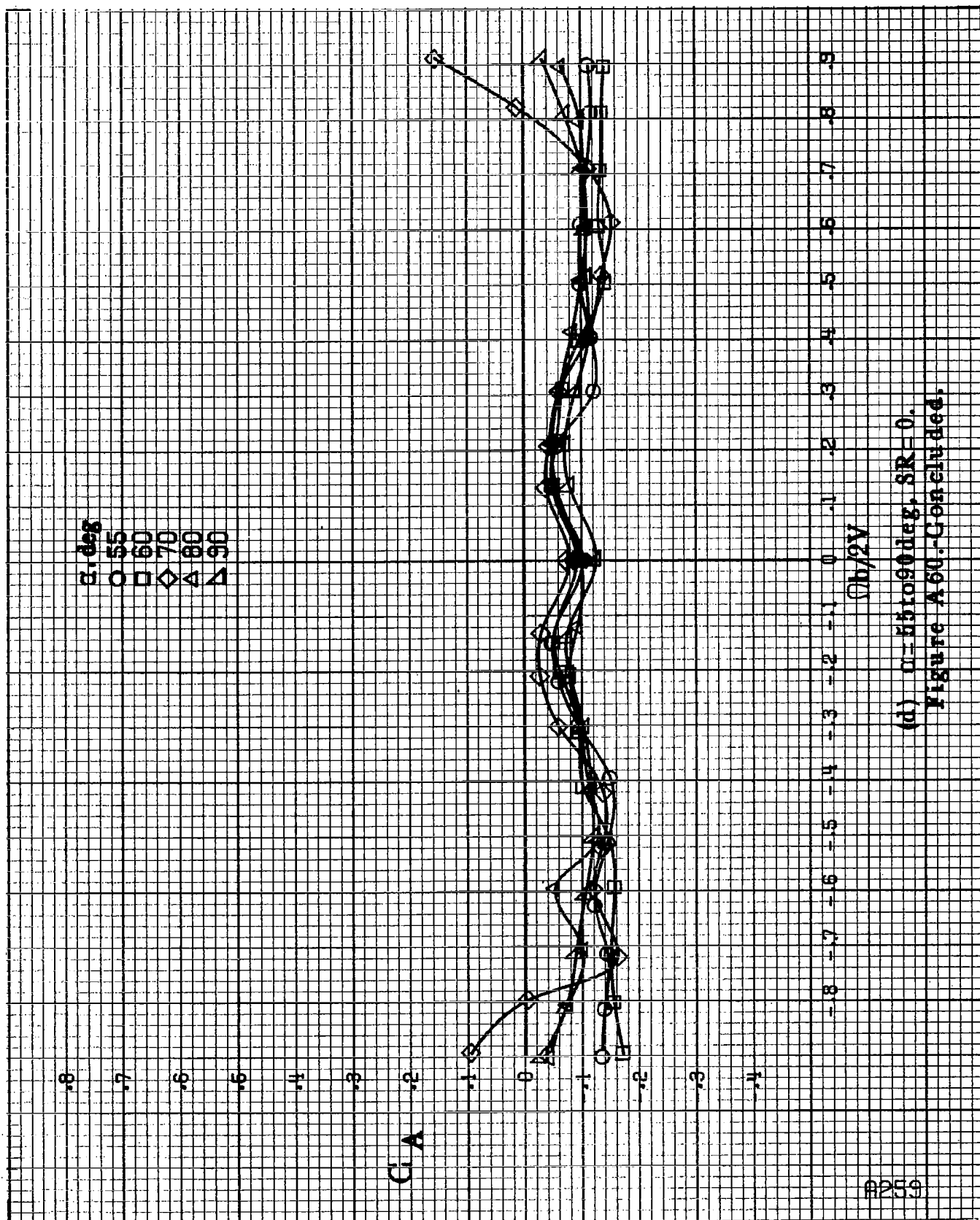
C<sub>A</sub>

$\alpha$ , deg  
 O 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▽ 50

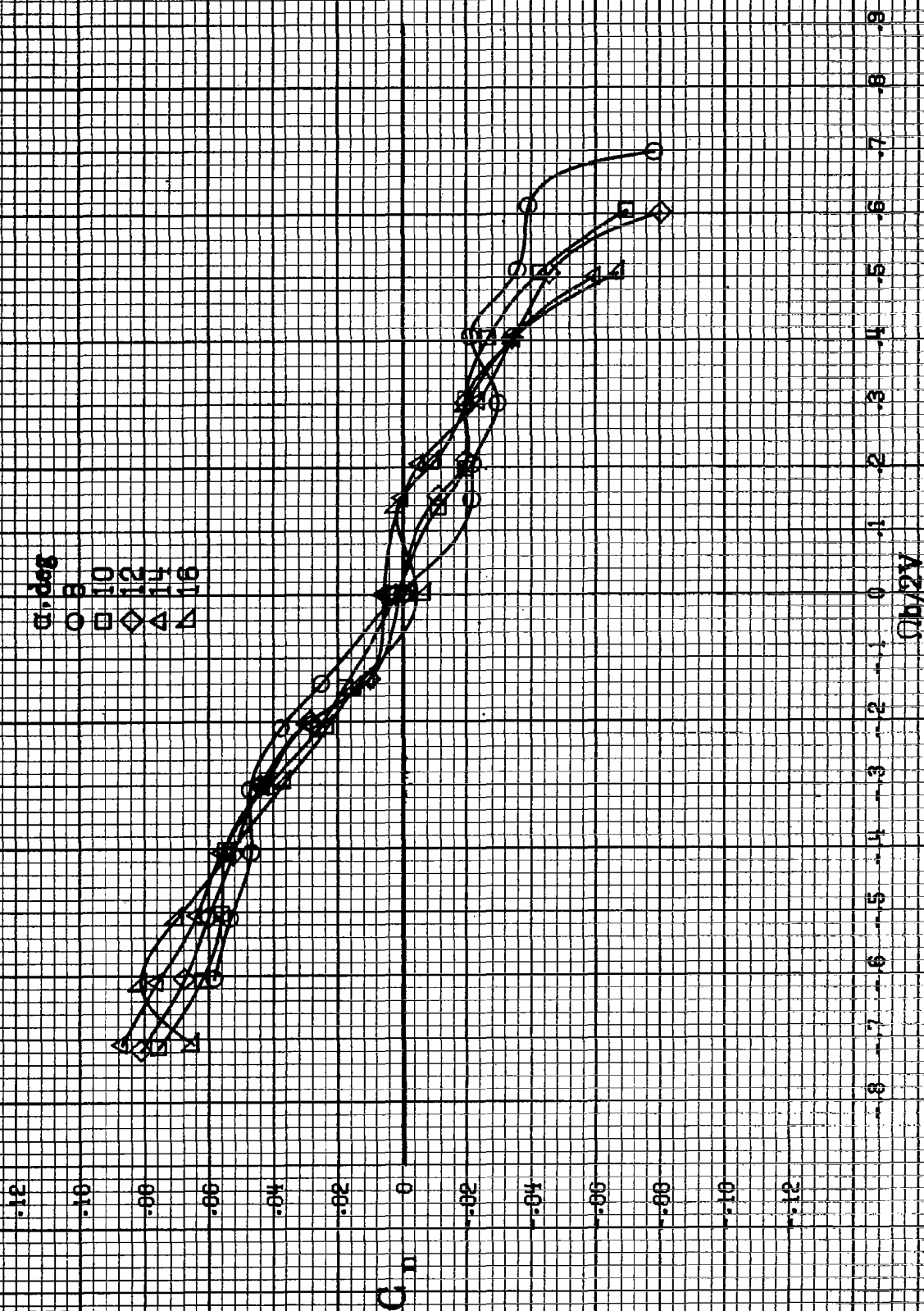
Ob/2V

(c)  $\alpha=30$  to  $50$  deg,  $SR=0$ .  
 Figure A60-Continued.





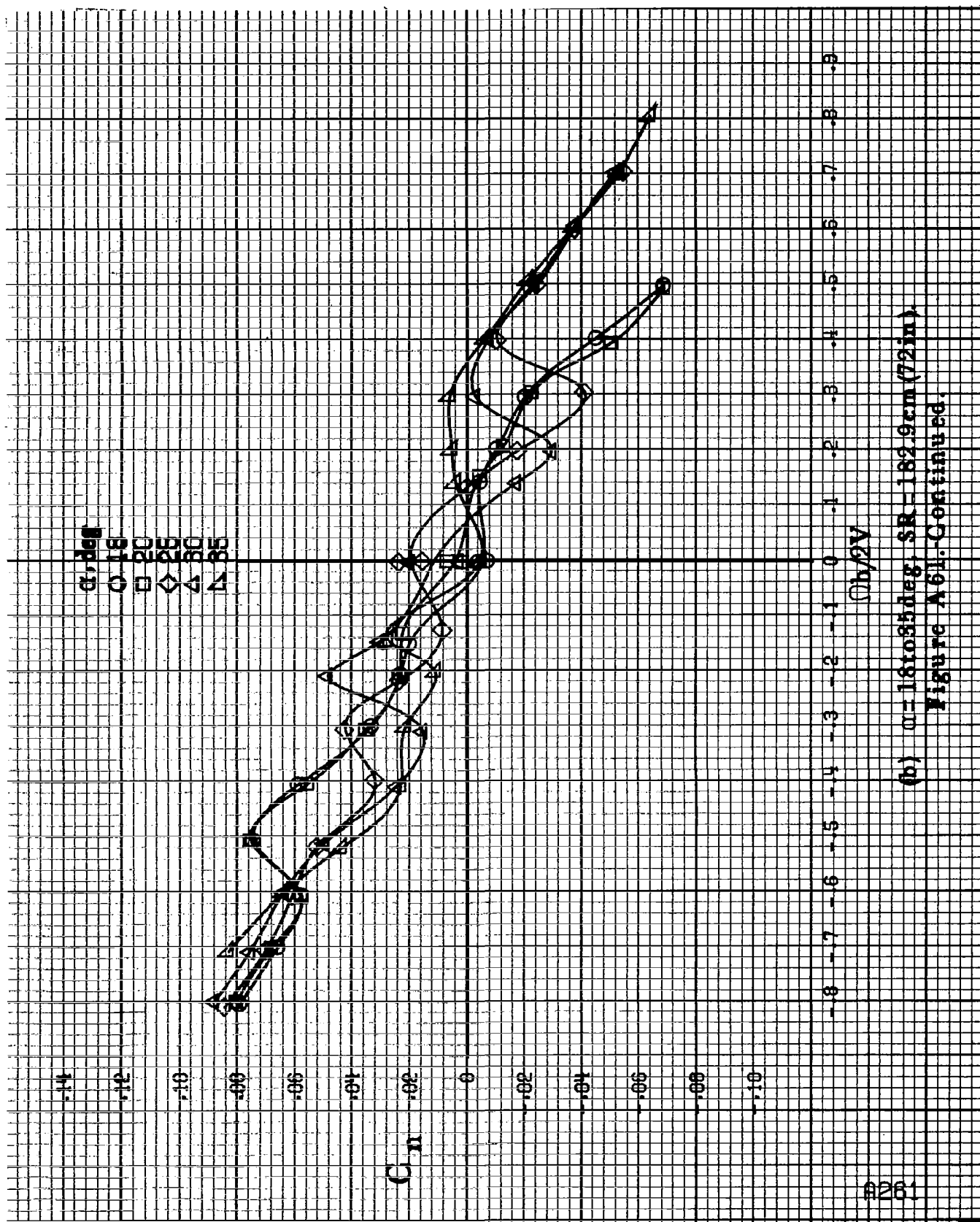
(d)  $\alpha = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A 60.-Concluded.



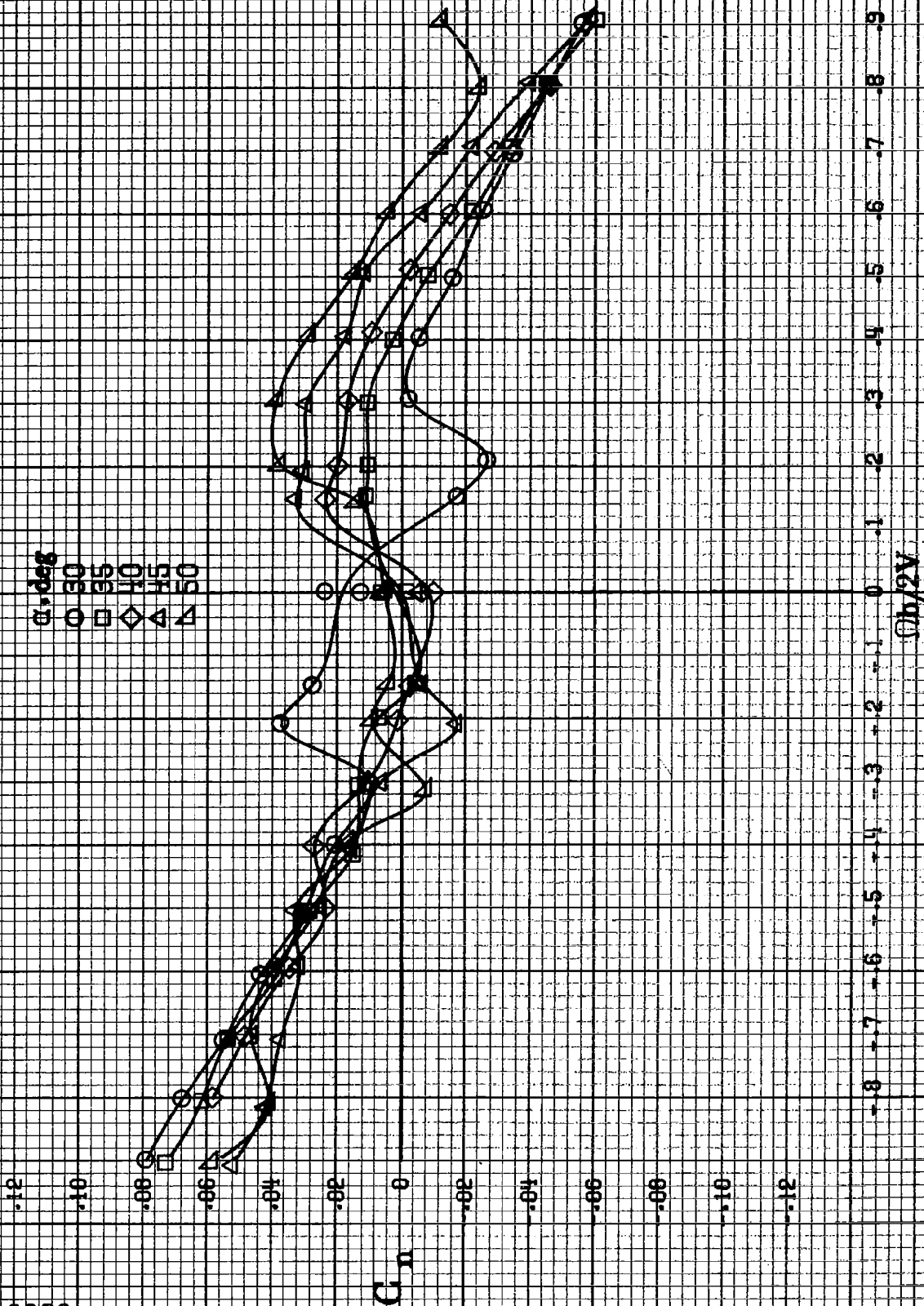
(a)  $\alpha = 8$  to  $16$  deg,  $SR = 132.9$  cm (72 in.).

Figure A61. Effect of rotation rate and angle of attack on yawing-moment coefficient for outboard L/E wing droop with large nose radius.  $\delta_a = 0^\circ$ ,  $\delta_r = 0^\circ$ ,  $\beta = 10^\circ$ .

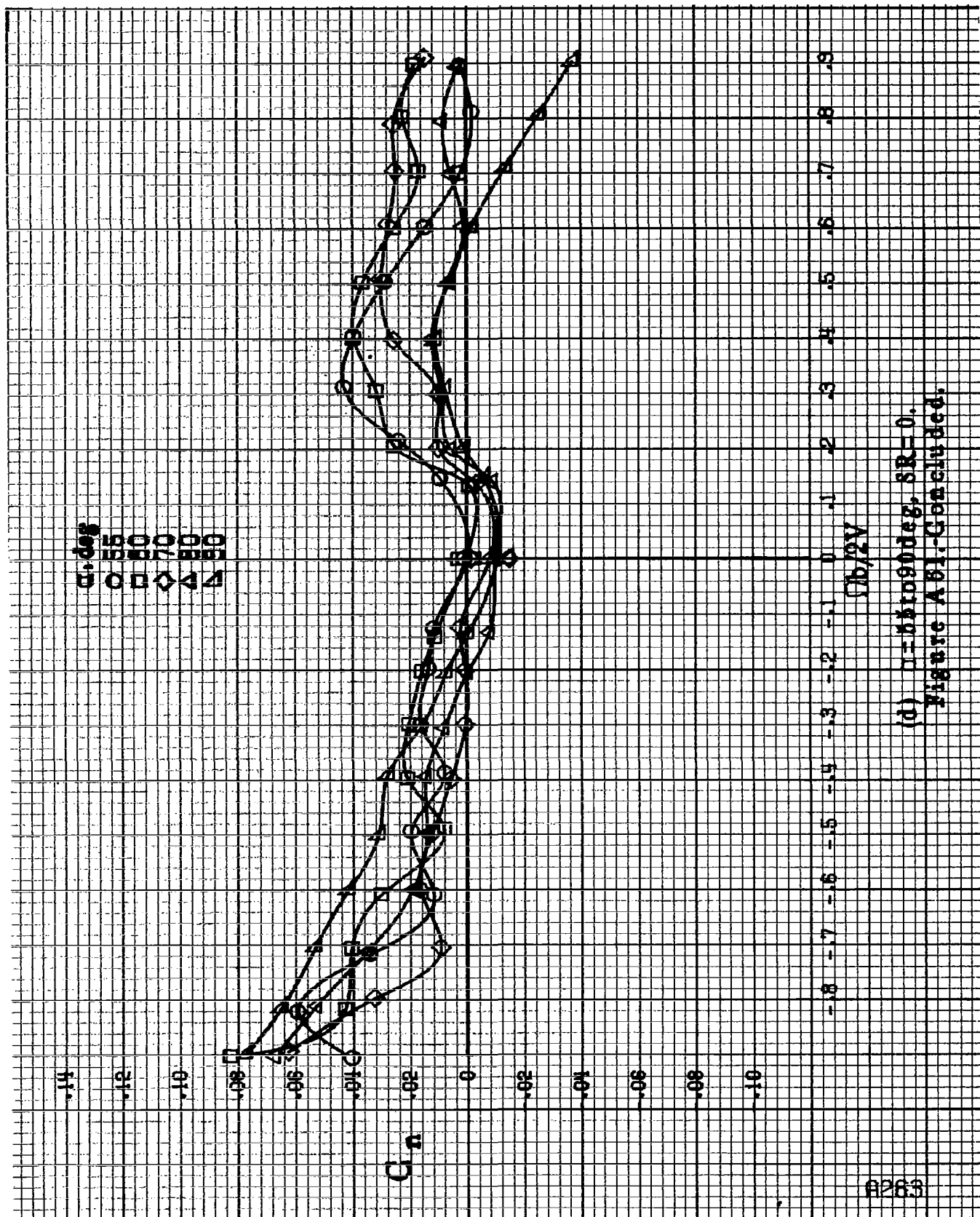




(b)  $\alpha = 18$  to  $35^\circ$ ,  $SR = 182.9 \text{ cm (72 in.)}$   
 Figure A611-Continued.



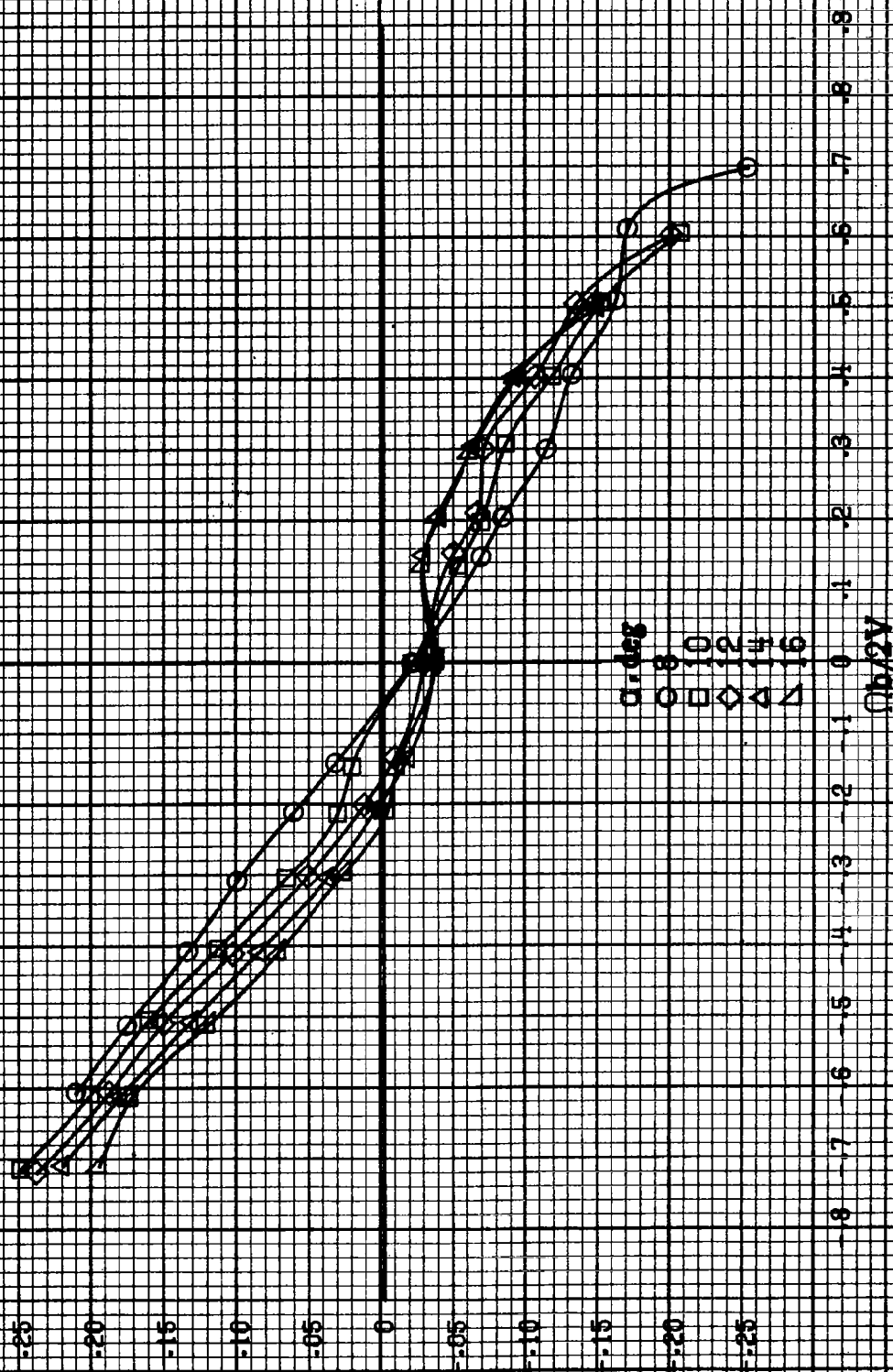
(c)  $\alpha = 30$  to  $50$  deg,  $SR = 0$ .  
Figure A51.-Continued.



(d)  $\Gamma = 0.0000$  deg,  $SR = 0$ .  
Figure A81. Concluded.

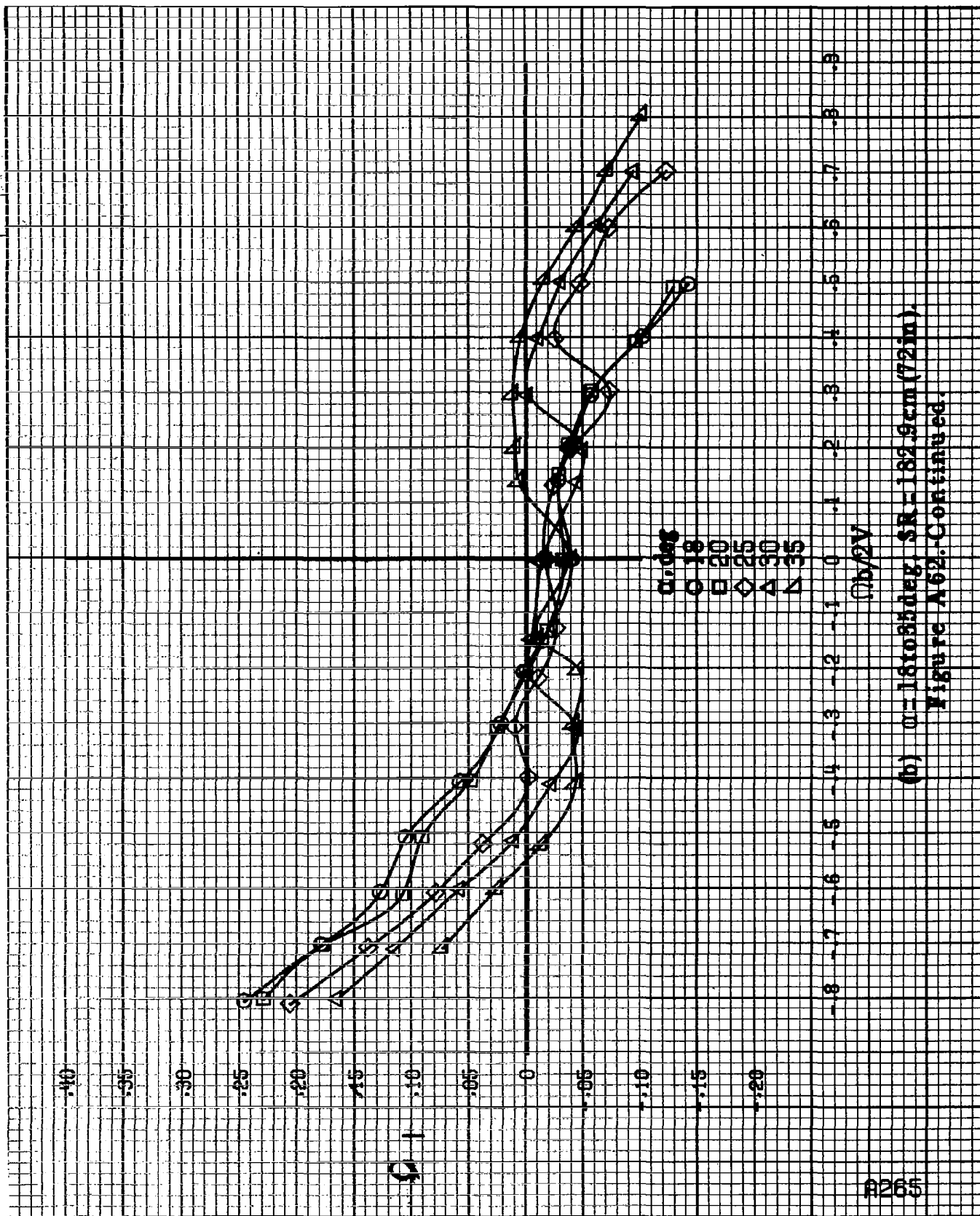
A264

$C_l$

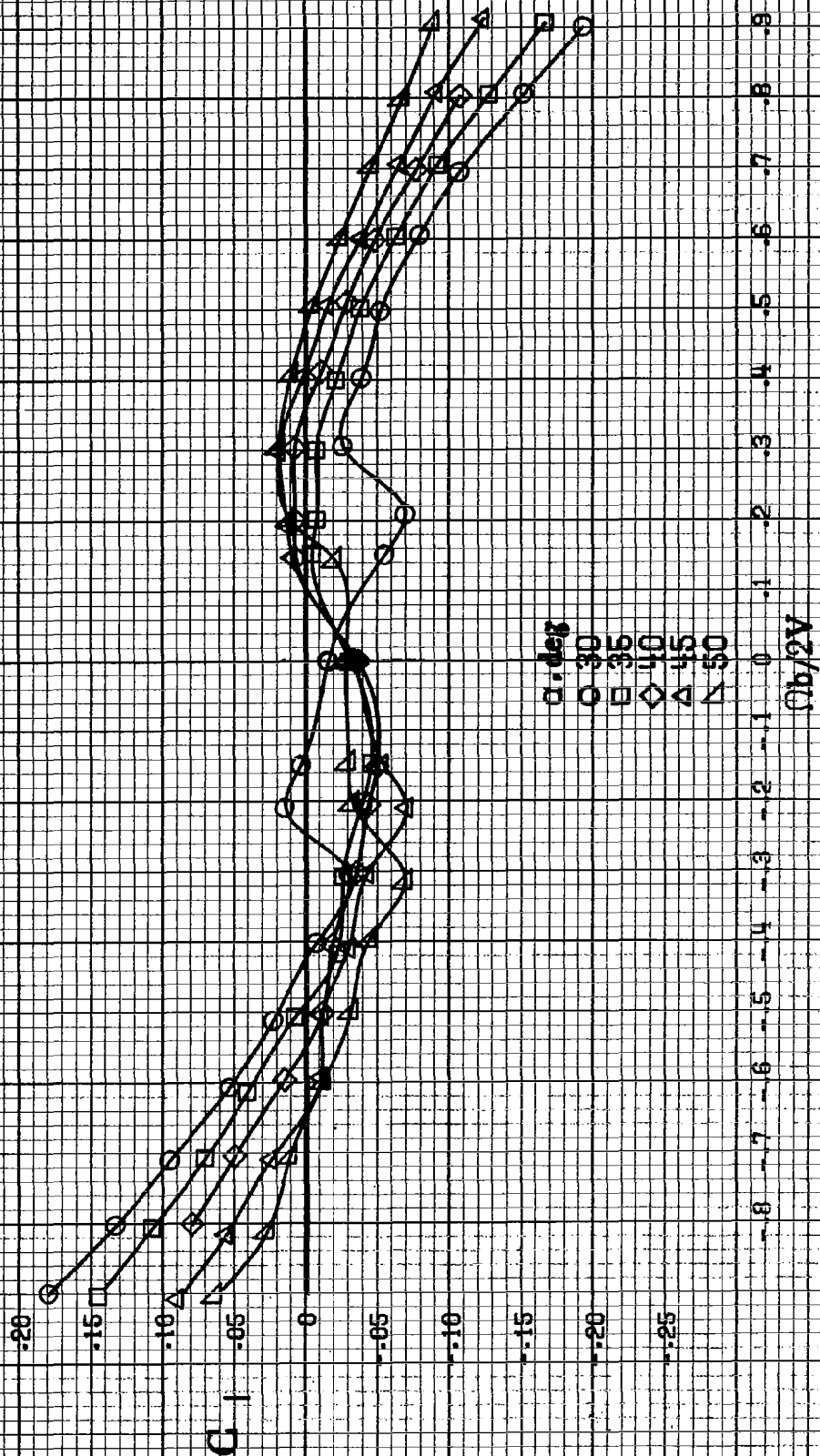


(a)  $\alpha = 84016 \text{ deg}$ ,  $SR = 182.9 \text{ cm} (72 \text{ in})$ .

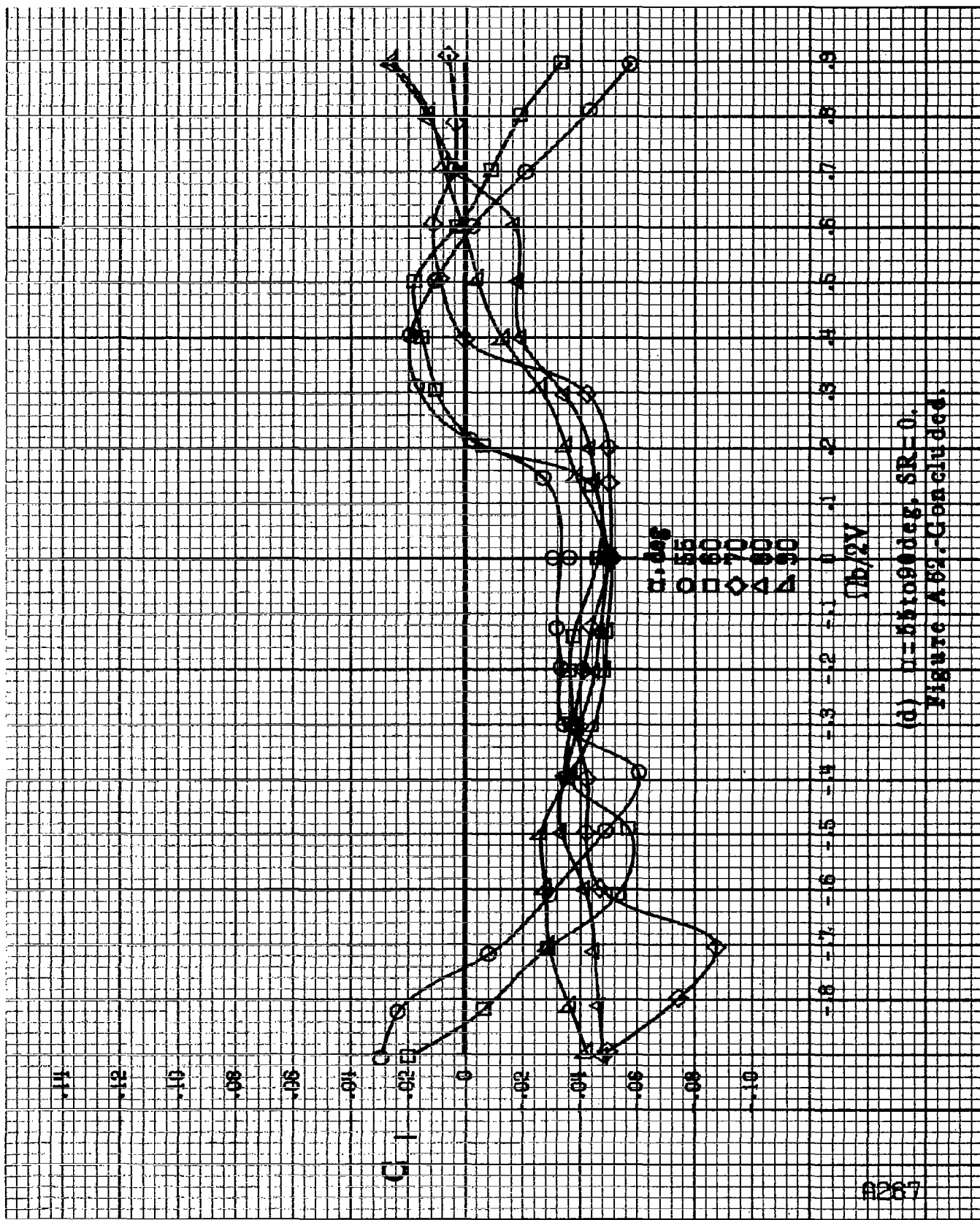
Figure A62. Effect of rotation rate and angle of attack on rolling moment coefficient for outboard L.E. wing droop with large nose radius.  $\delta_a = 0^\circ$ ,  $\delta_s = 0^\circ$ ,  $\delta = 10^\circ$ .



(b)  $u = 18$  to  $35$  deg,  $SR = 182.9 \text{ cm (72 in.)}$ .  
Figure A62-Continued.

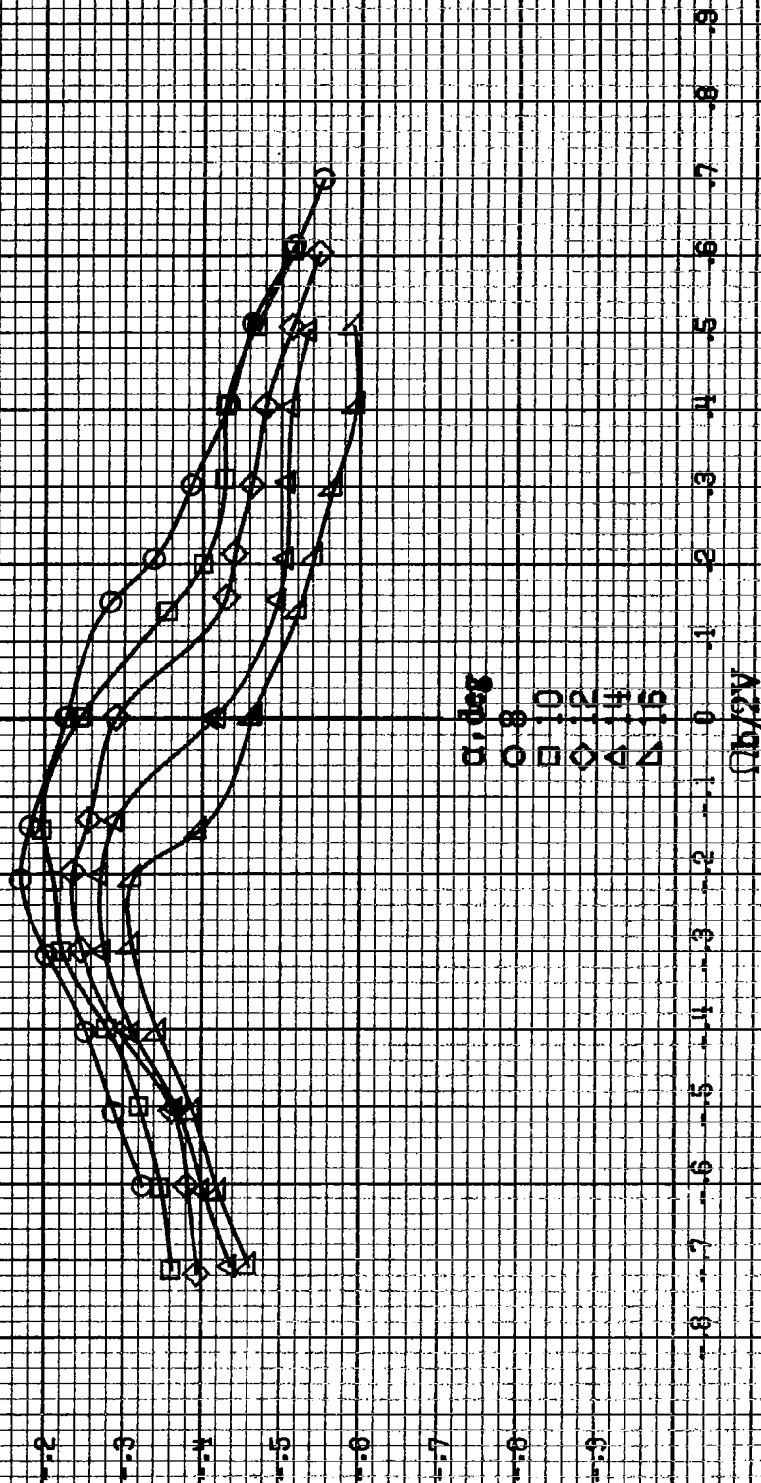


(c)  $\alpha = 30$  to  $50$  deg,  $SR = 0$ .  
Figure A62.-Continued.



(d)  $\mu = 61000 \text{ deg}$ ,  $SR = 0$ ,  
Figure A82- Concluded.

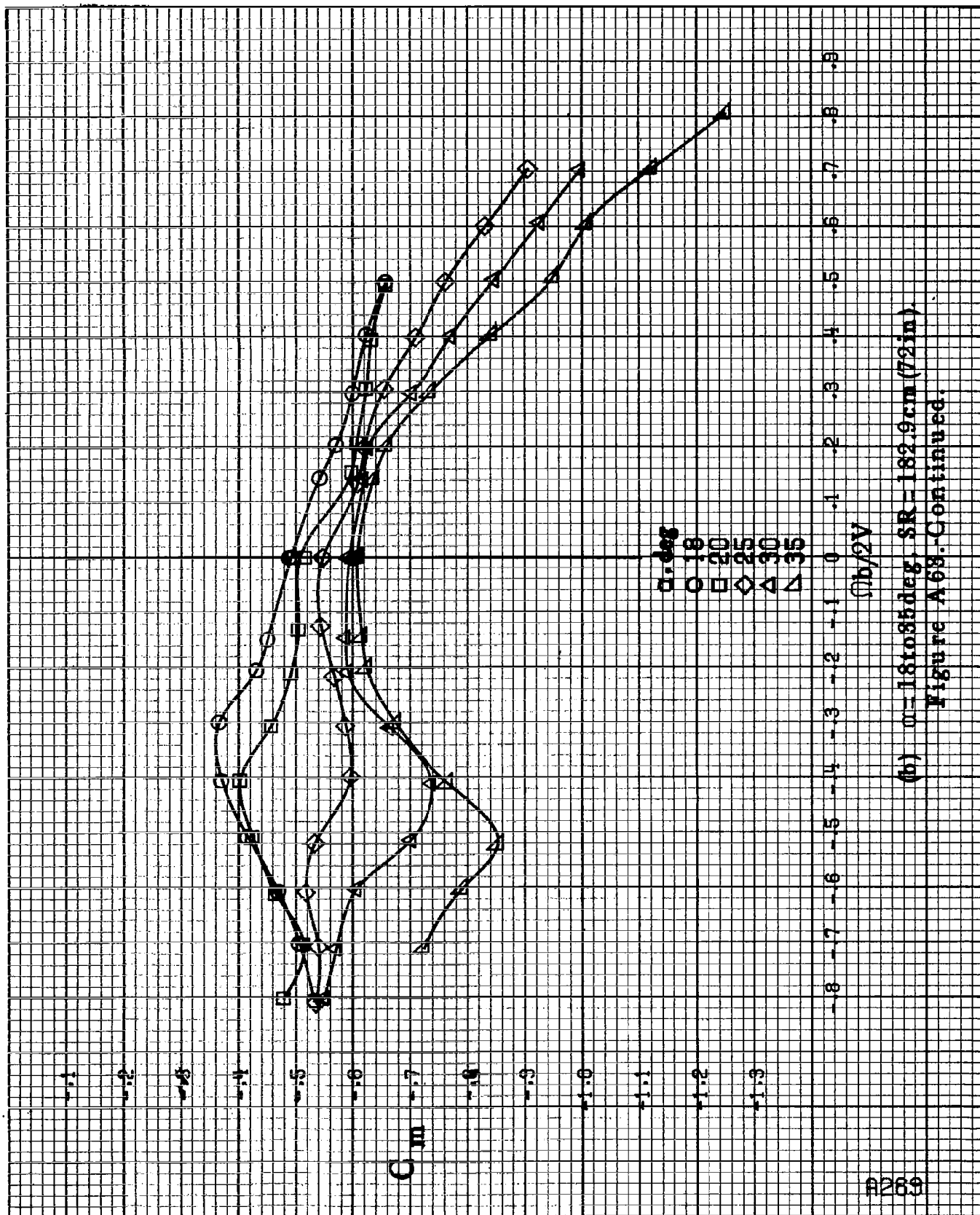
$C_m$



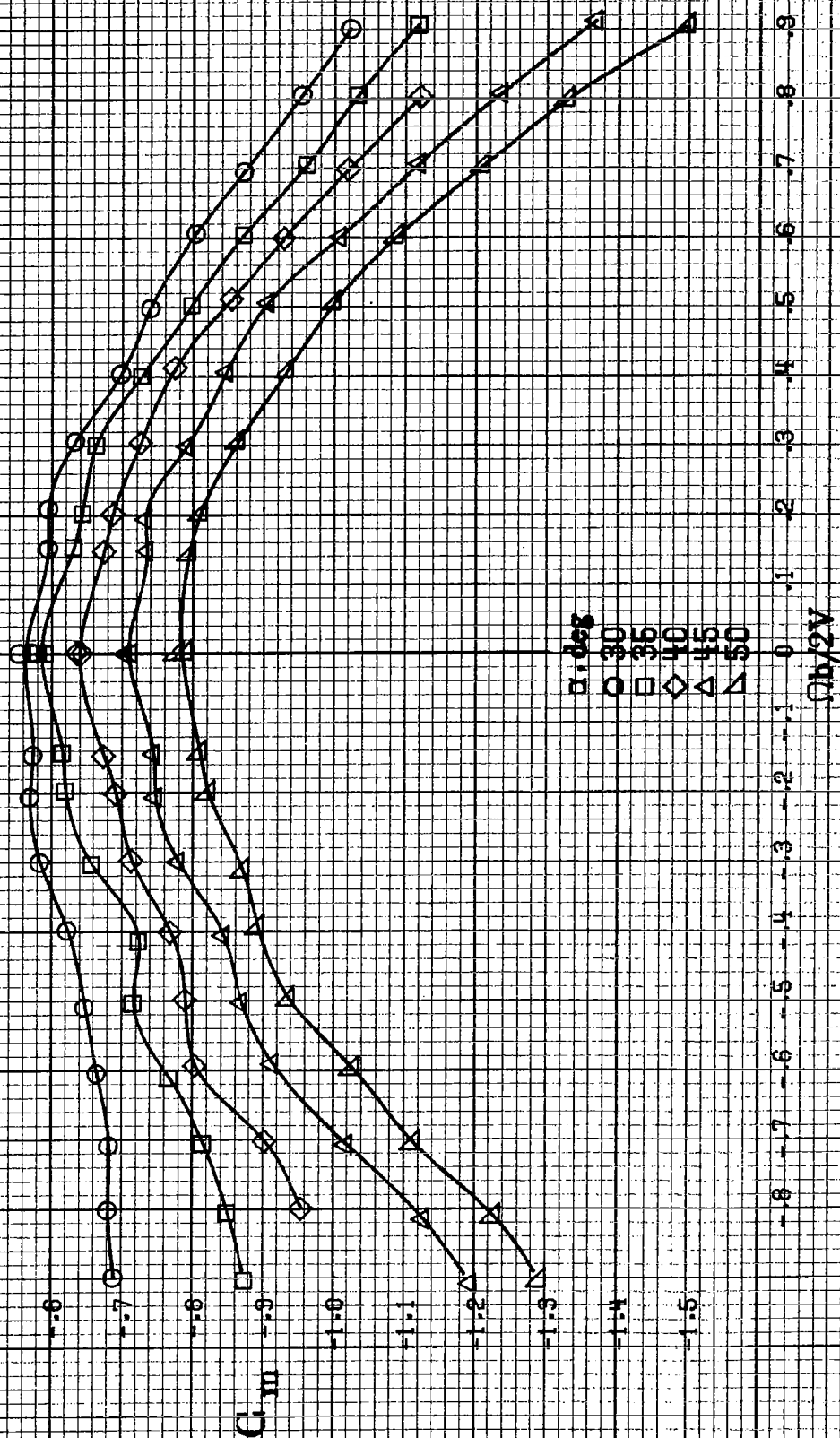
(a)  $\alpha = 8$  to  $16^\circ$ ,  $SR = 132.9$  cm (72 in).

Figure A.63.-Effect of rotation rate and angle of attack on pitching moment coefficient for outboard LE wing droop with large nose radius.  $\delta_n = 0^\circ$ ,  $\delta_a = 0^\circ$ ,  $\delta_r = 0^\circ$ ,  $\beta = 10^\circ$ .

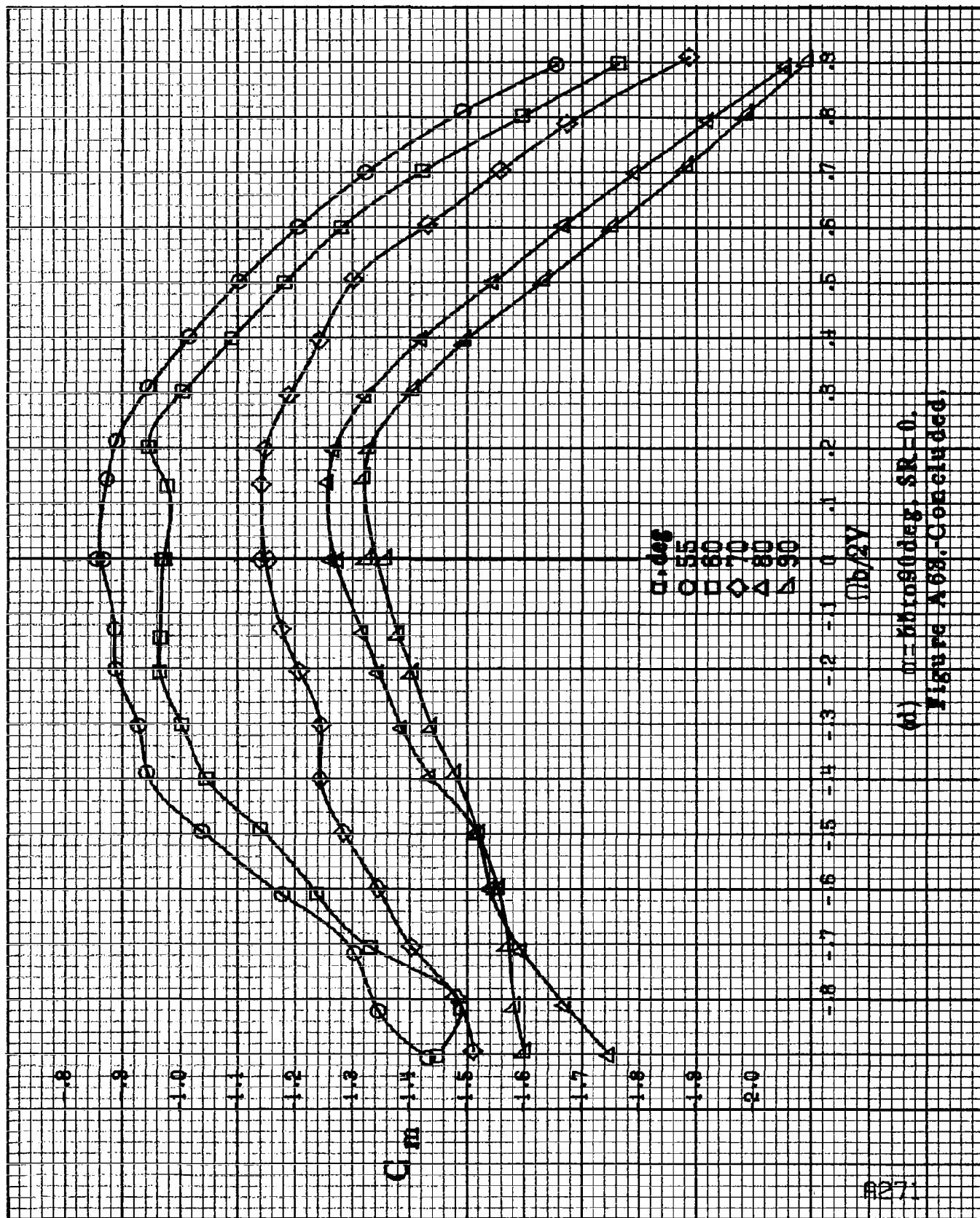




(b)  $\alpha = 18$  to  $35^\circ$ , SR-182.9cm (72in)  
Figure A68-Continued.



(a)  $\alpha = 30$  to  $50$  deg,  $SR = 0$ .  
Figure A68.-Continued.



(d)  $\alpha = 80^\circ$ ,  $SR = 0$ .  
Figure A63. Concluded.

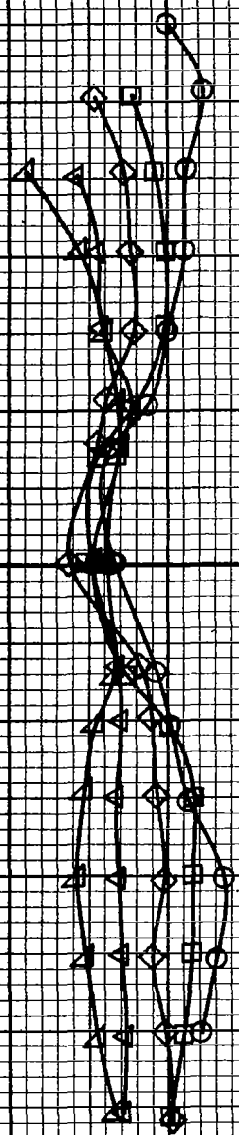
$\alpha, \text{deg}$   
 8  
 10  
 12  
 14  
 16

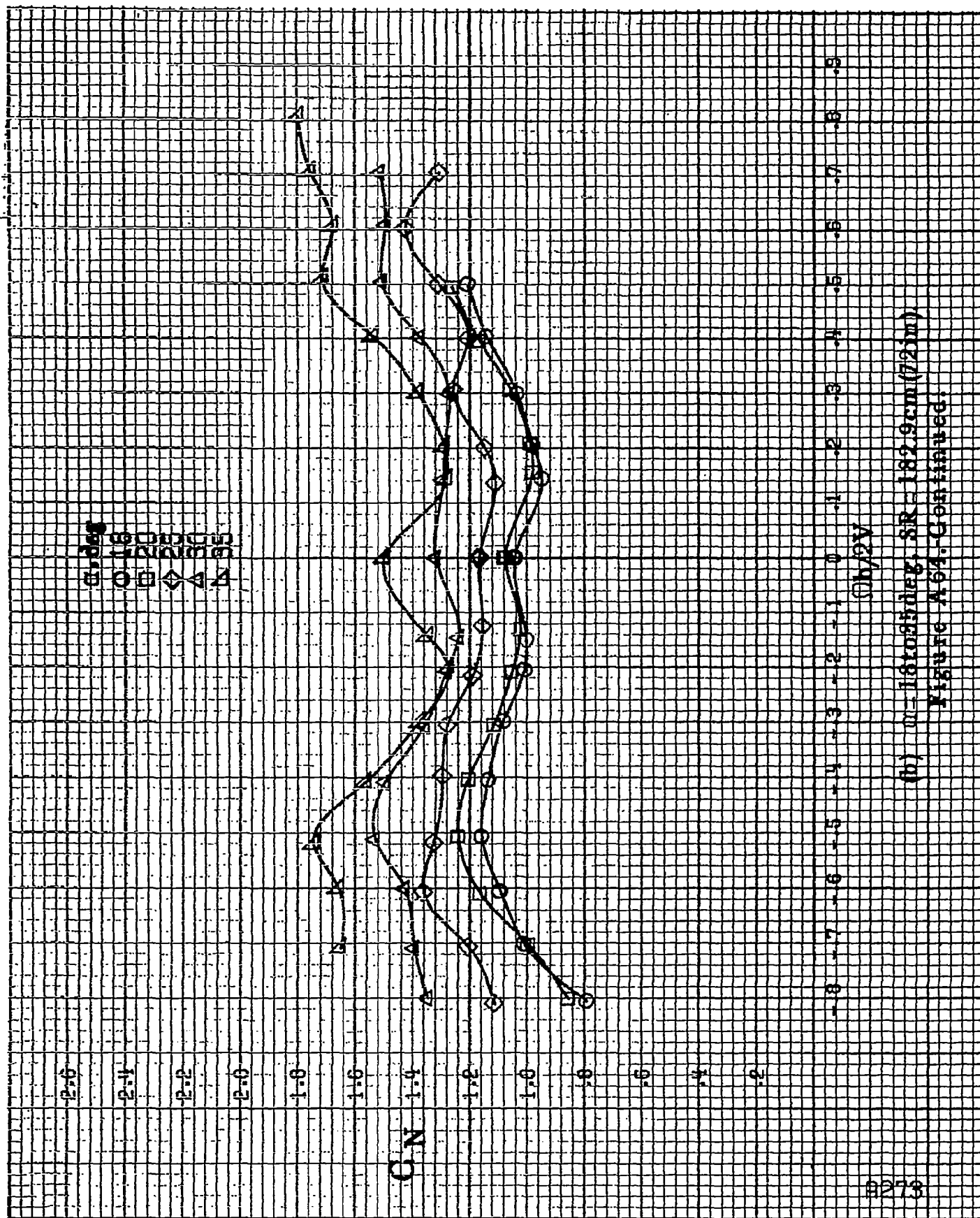
$C_N$

$(h/2V)$

(a)  $\alpha = 8 \text{ to } 16 \text{ deg}$ ,  $SR = 182.0 \text{ cm (72 in)}$ .

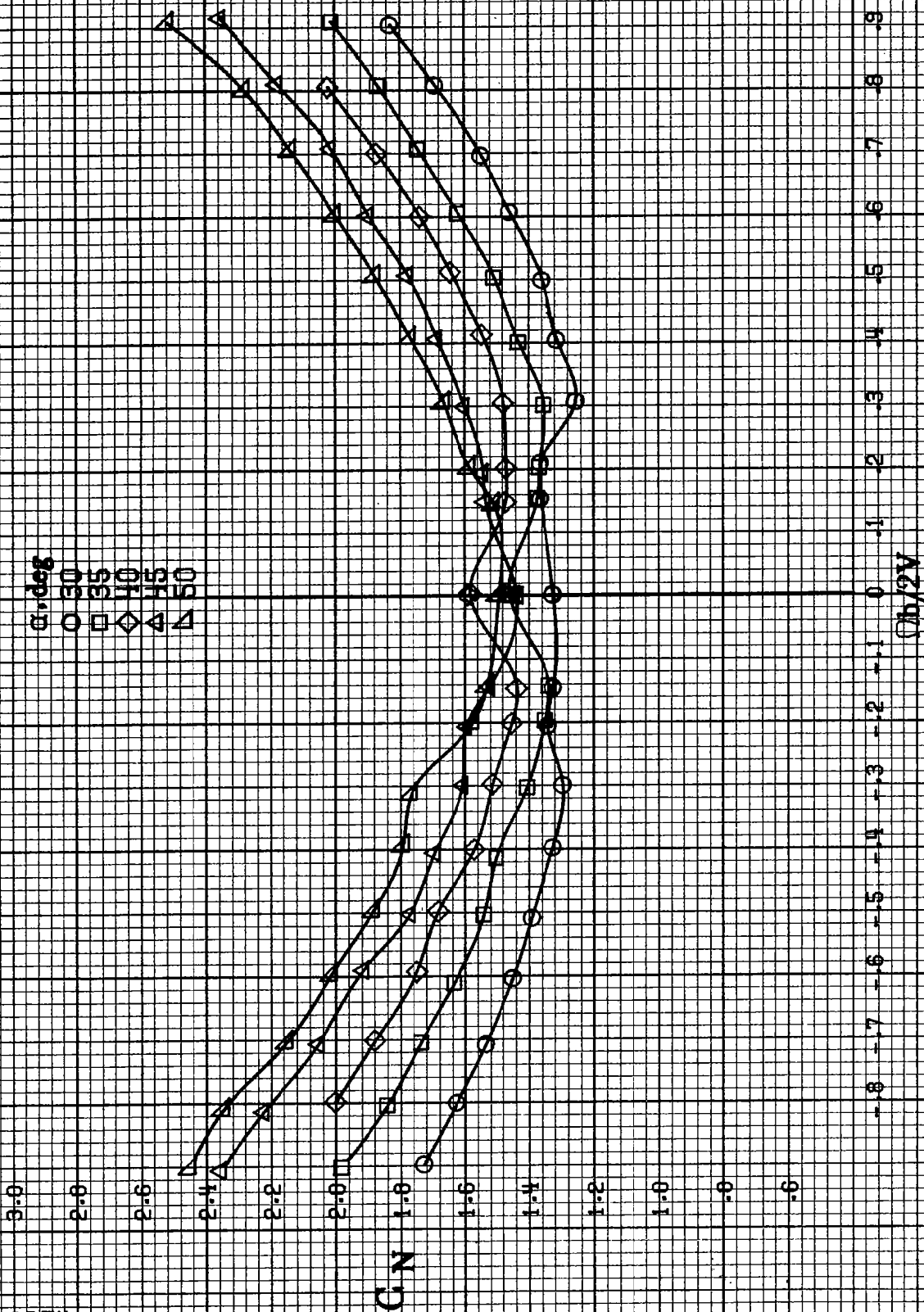
Figure A64. Effect of rotation rate and angle of attack on normal-force coefficient for outboard LE wing droop with large nose radius.  $\delta_n = 0^\circ$ ,  $\delta_r = 0^\circ$ ,  $\beta = 10^\circ$ .



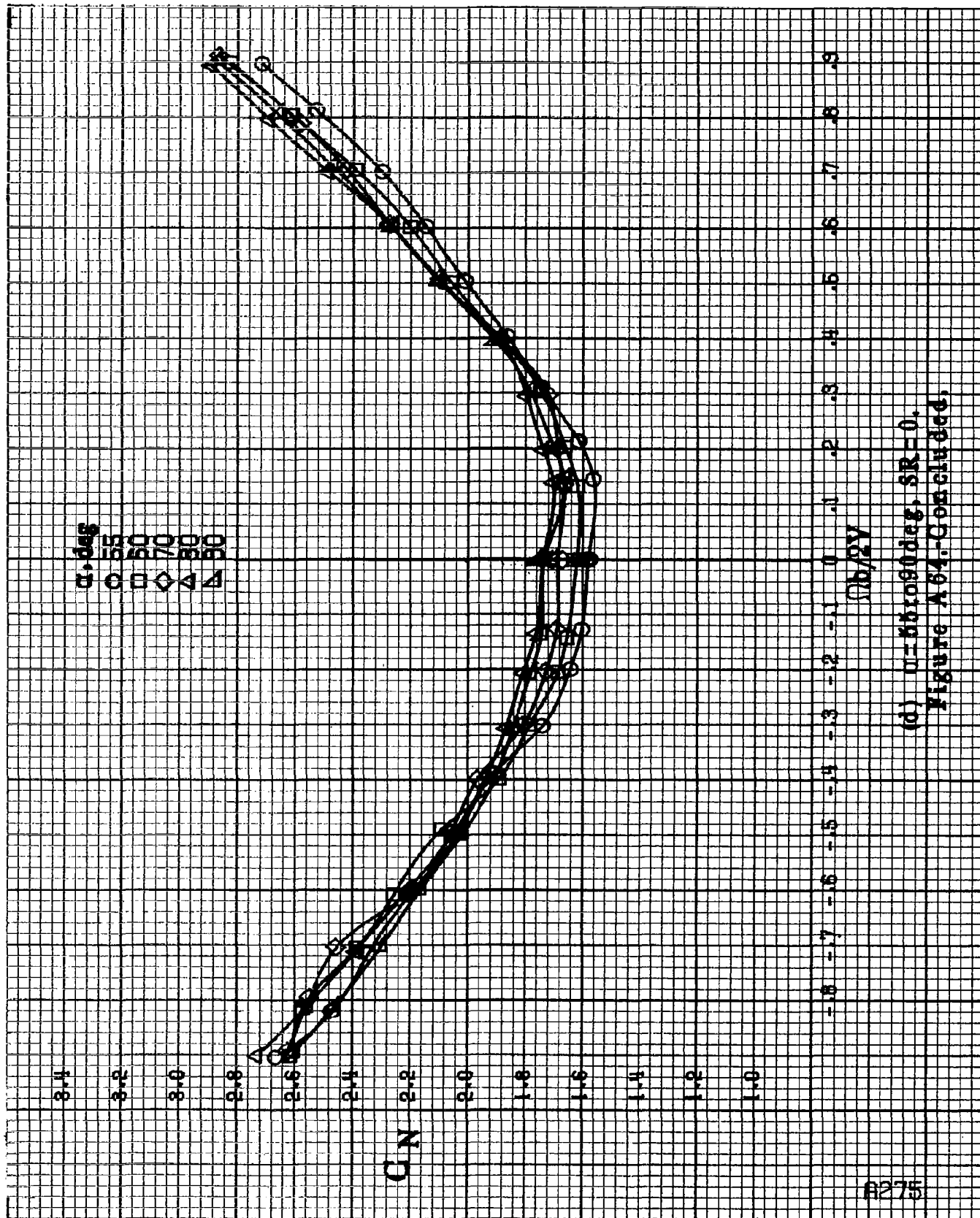


(b)  $\omega = 18005 \text{ deg}$ ,  $SR = 182.9 \text{ cm (72 in)}$   
 Figure A64. Continued.

8274



(c)  $u=30$  to  $50$  deg,  $SR=0$ .  
Figure A54-Continued.

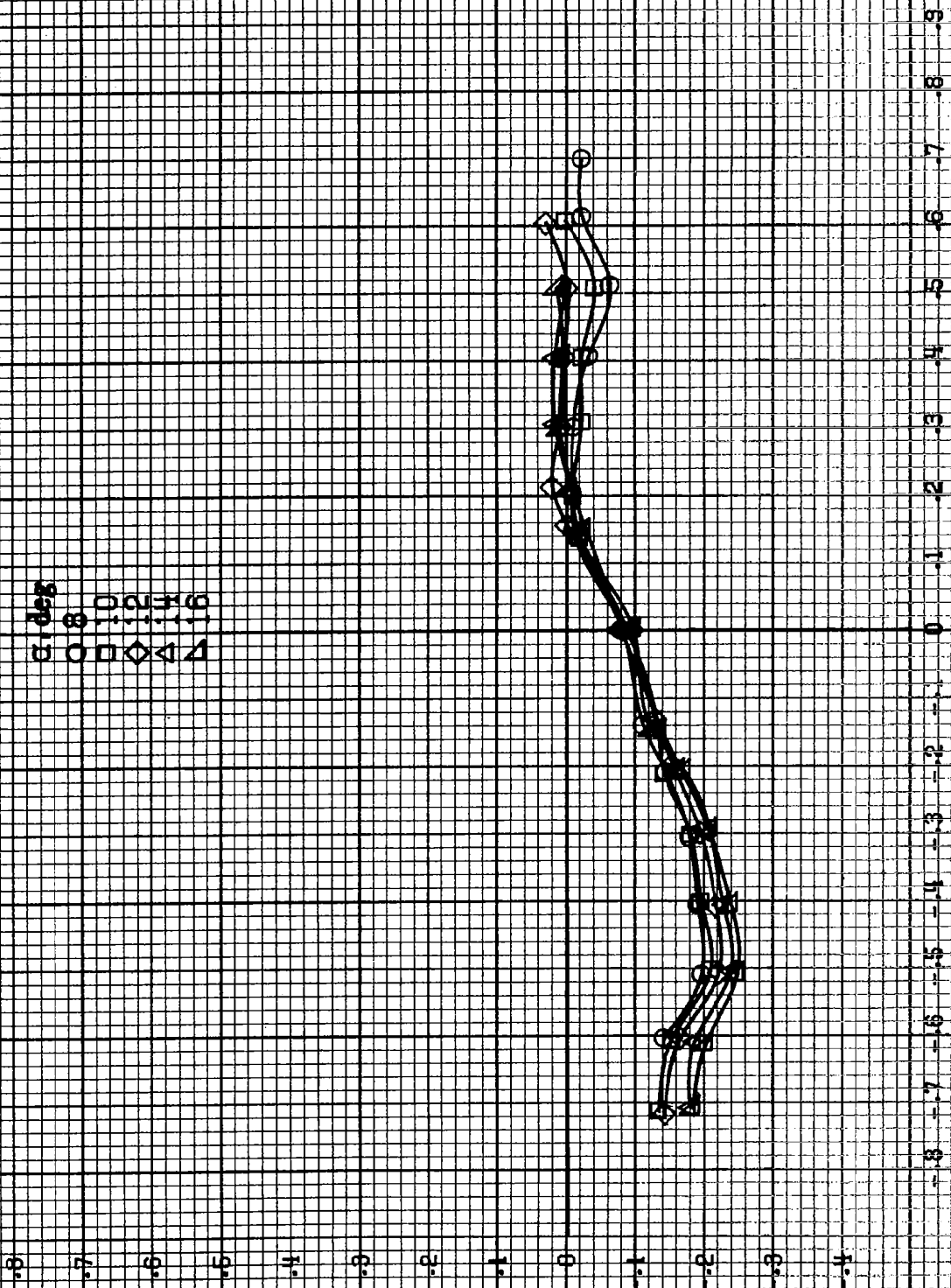


(d)  $\alpha=60$ deg,  $SR=0$ .  
Figure A64-Continued.

8276

$\alpha, \text{deg}$   
 0 8  
 10 12  
 14 16

$C_L$



(a)  $\alpha = 8$  to  $16$  deg,  $S_R = 132.9 \text{ cm}^2 (72 \text{ in}^2)$ .

Figure A.55. Effect of rotation rate and angle of attack on side-force coefficient for outboard LE wing droop with large nose radius.  $\delta_n = 10^\circ$ ,  $\delta_s = 10^\circ$ ,  $\delta_v = 0^\circ$ ,  $\beta = 10^\circ$ .



$\alpha$ , deg  
 O 18  
 □ 20  
 ◇ 25  
 △ 30  
 ▲ 35

$C_L Y$

$Qh/2V$

(b)  $\alpha = 18$  to  $35$  deg,  $SR = 182.9$  cm (72 in).  
 Figure A65-Continued.

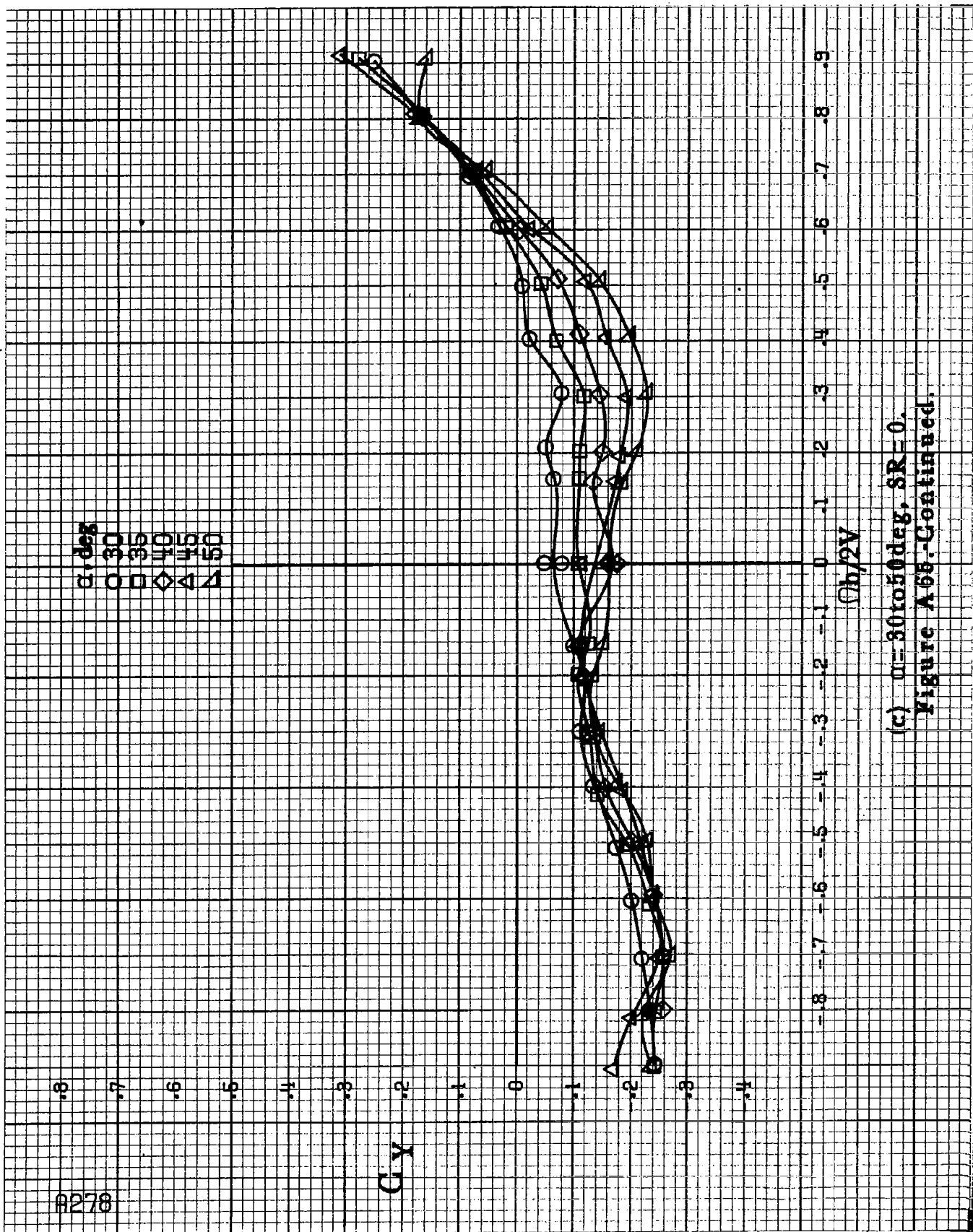
A278

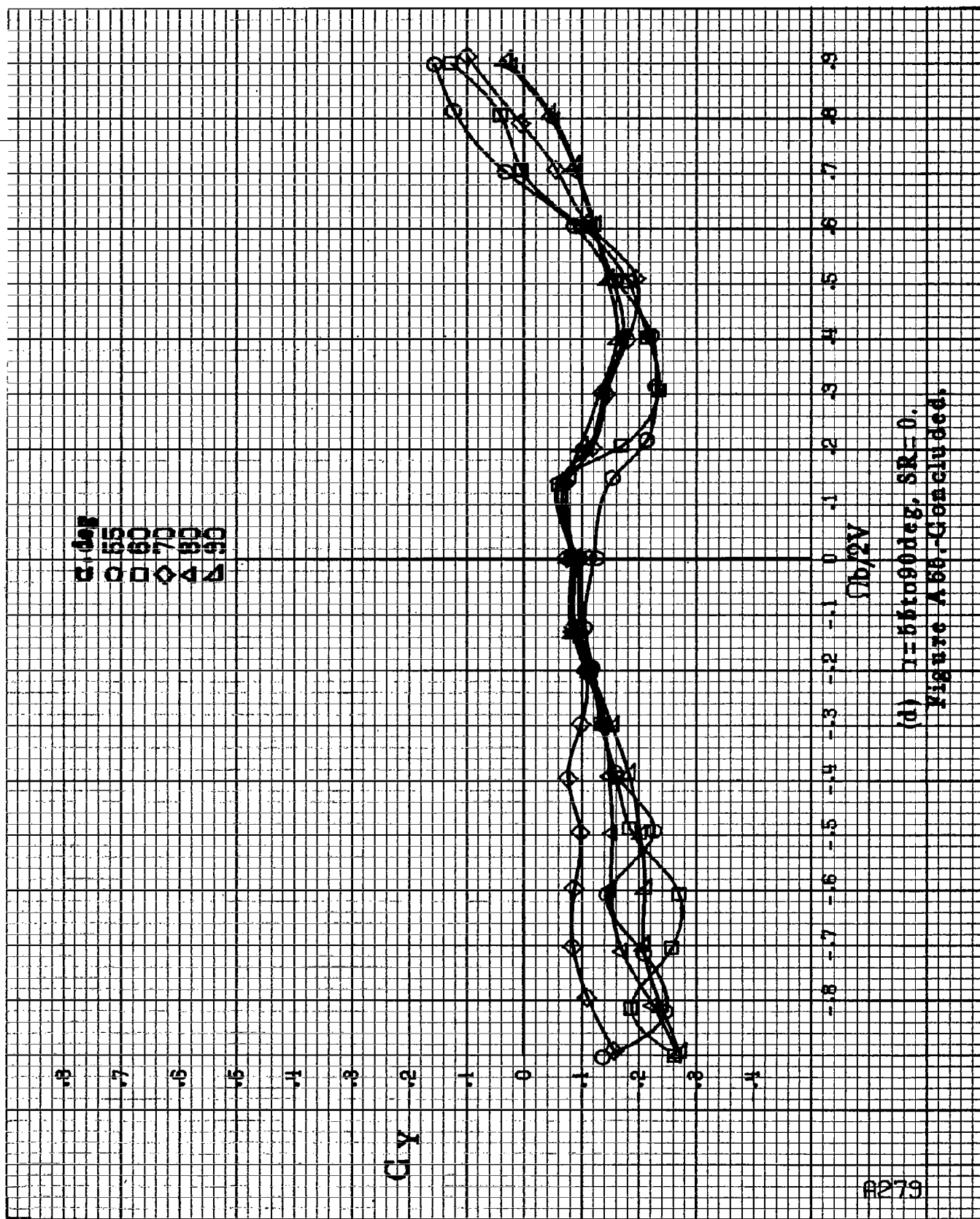
$\alpha$ , deg  
 ○ 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▽ 50

$C_y$

$\phi_b/2V$

(c)  $\alpha=30$  to  $50$  deg,  $\delta R=0$ .  
 Figure A66-Continued.

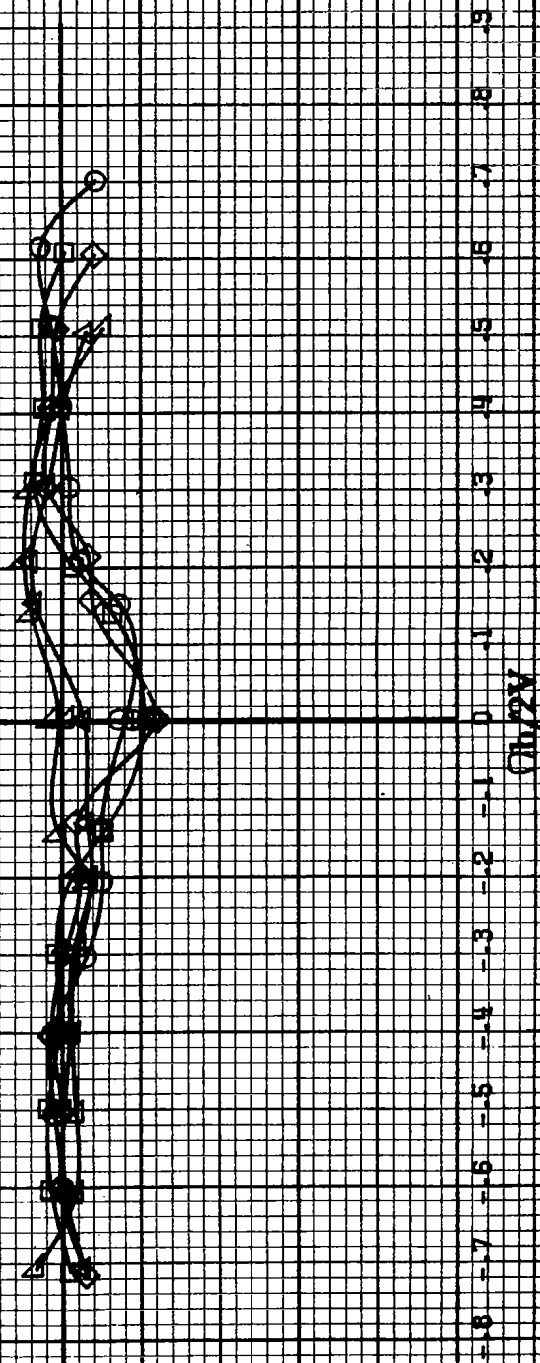




(d)  $\gamma = 65$  to  $90$  deg,  $SR = 0$ .  
 Figure A56 - Continued.

$\alpha, \text{deg}$   
 0 8  
 10  
 12  
 14  
 16

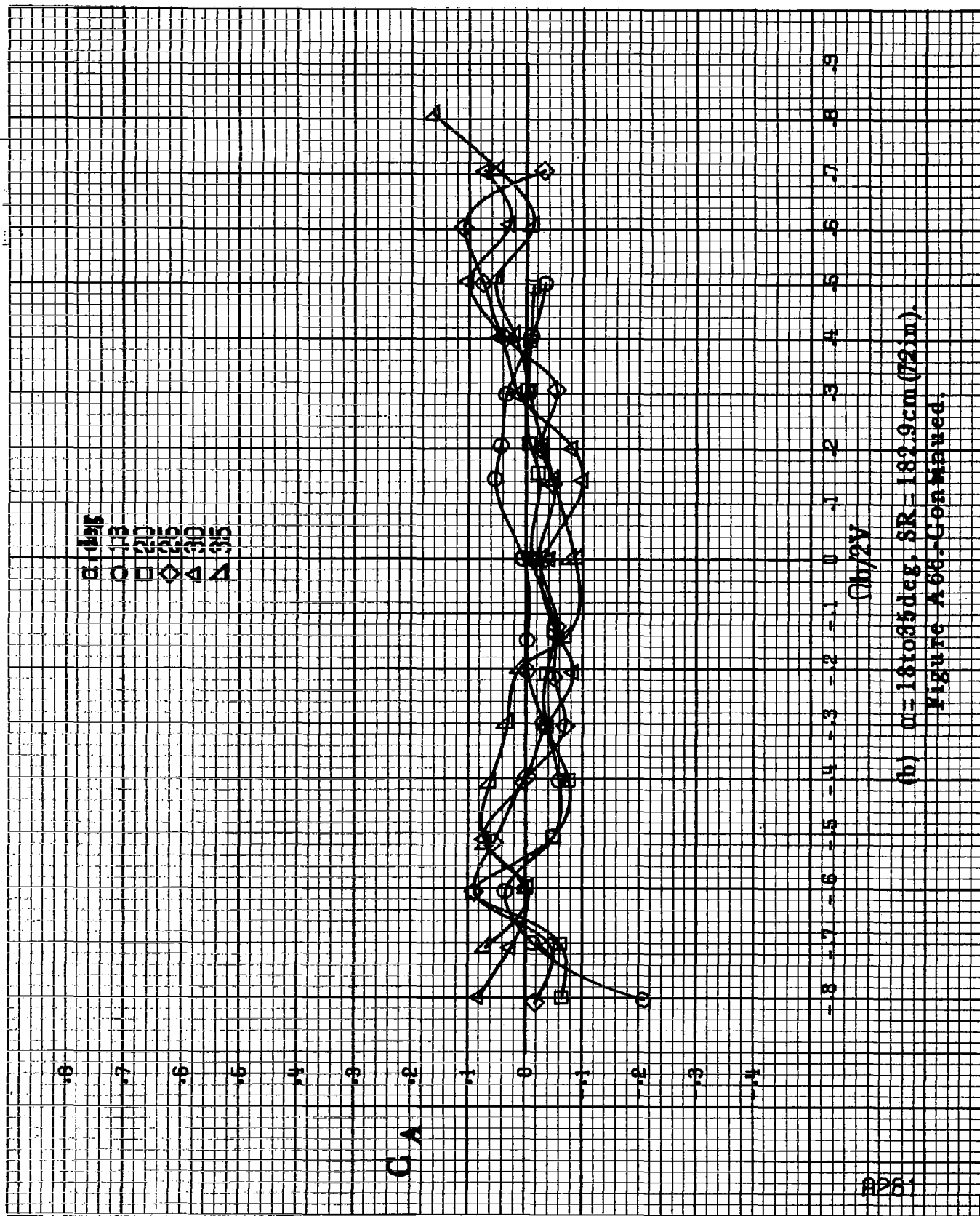
$C_A$



$Ch/2V$

(a)  $\alpha = 8 \text{ to } 16 \text{ deg}$ ,  $SR = 182.9 \text{ cm (72 in)}$ .

Figure A88.—Effect of rotation rate and angle of attack on axial-force coefficient for outboard LB wing droop with large nose radius.  $\delta = 0^\circ$ ,  $\delta = 10^\circ$ ,  $\delta = 20^\circ$ .



(b)  $\omega = 180855 \text{ deg}$ ,  $SR = 182.9 \text{ cm (72 in)}$   
 Figure A66-Continued.

8282

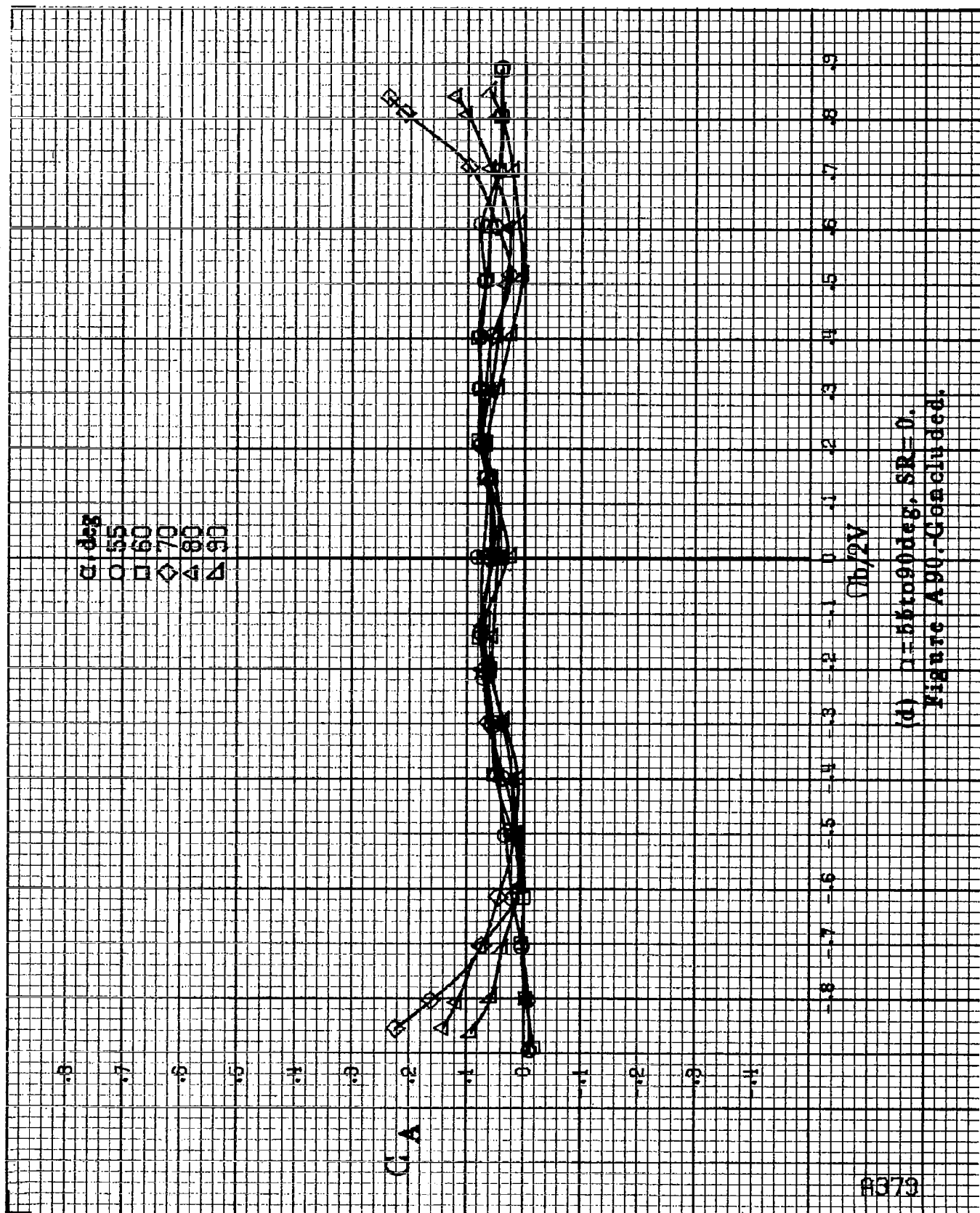
$\alpha$ , deg  
 O 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▽ 50

C<sub>1</sub>A



$Ch/2V$

(c)  $\alpha=30$  to  $50$  deg,  $SR=0$ .  
 Figure A 56, Continued.



(d)  $\gamma = 85$  to  $90$  deg,  $SR = 0$ .  
Figure A90. Concluded.

8380

$\alpha, \text{deg}$   
 8  
 10  
 12  
 14  
 16

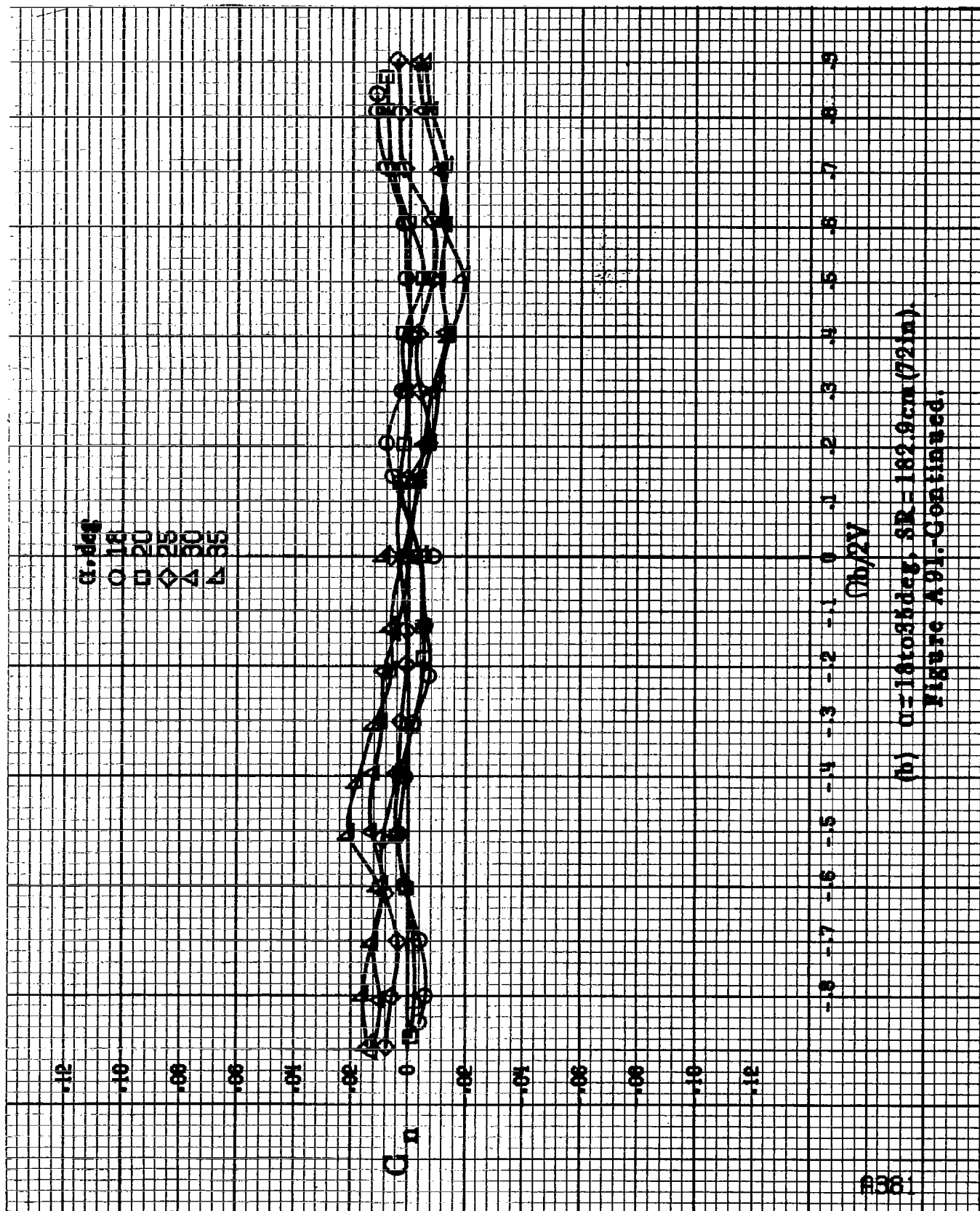
$C_n$

$\Omega, \text{2V}$

(a)  $\alpha = 8$  to  $16 \text{ deg}$ ,  $S_R = 182.9 \text{ cm} (72 \text{ in})$ .

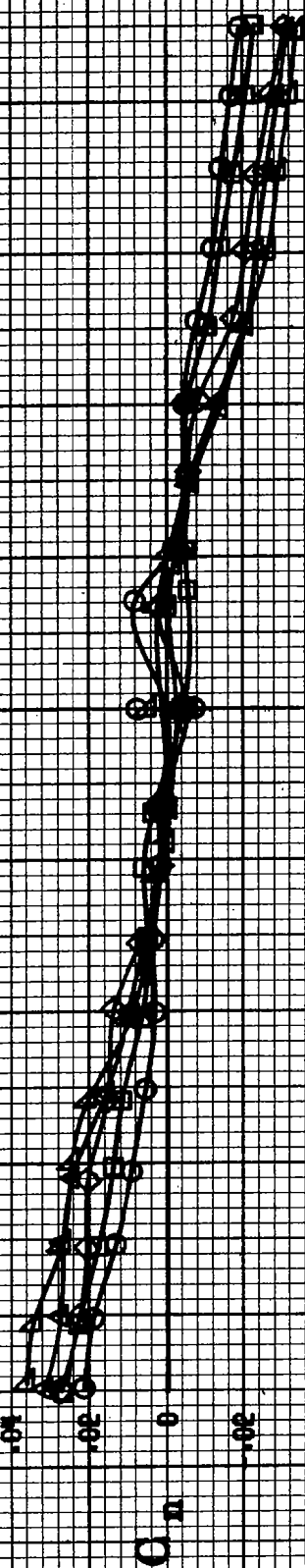
Figure A91. Effect of rotation rate and angle of attack on yawing-moment coefficient for vertical tail off configuration.  $\delta_a = 0^\circ$ ;  $\delta_r = 0^\circ$ ;  $\delta = 0^\circ$ .



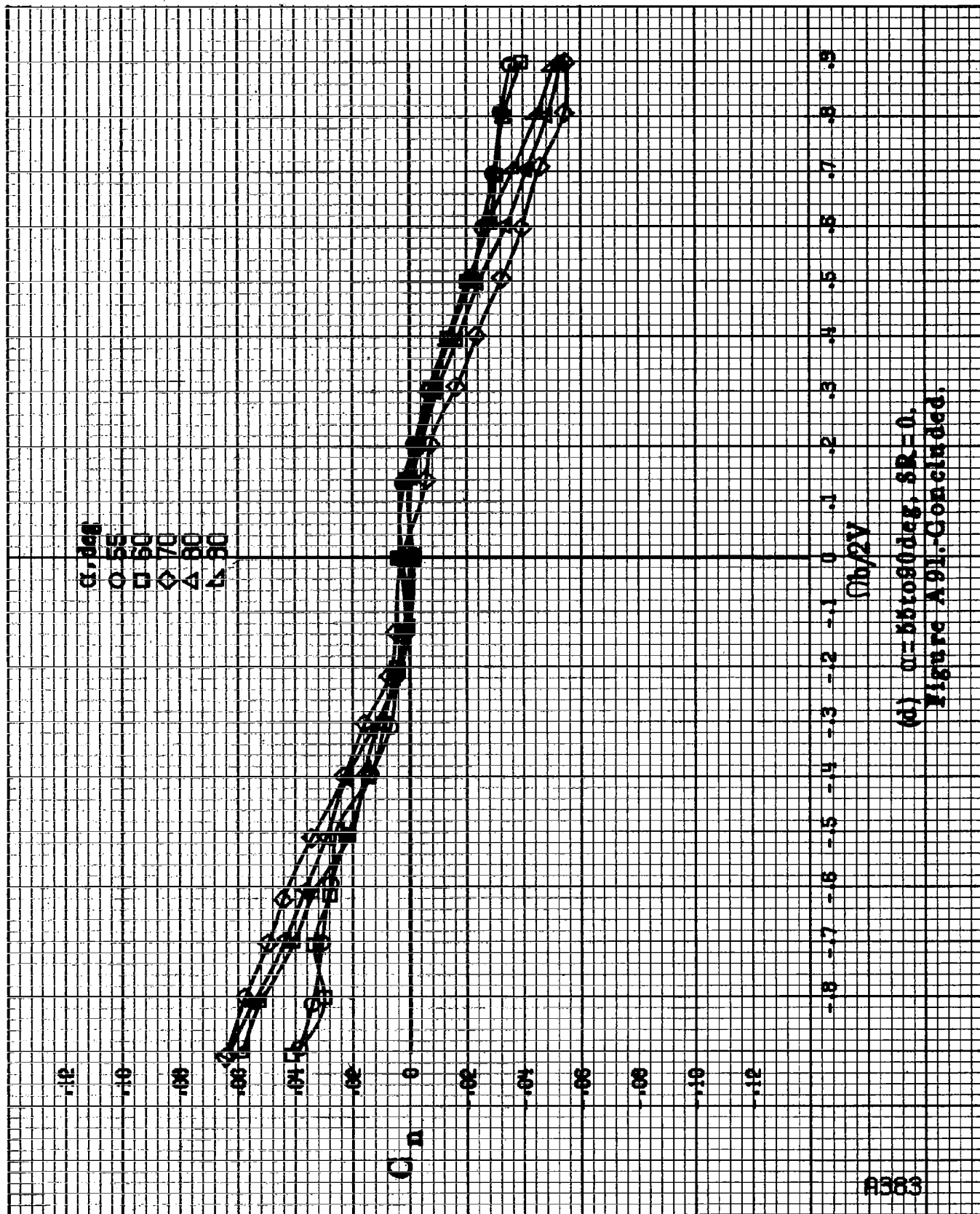


A382

$\alpha$ , deg  
 50  
 35  
 10  
 15  
 50



(c)  $\alpha = 80$  to  $0$  deg,  $SR = 0$ ,  
 Figure A91.-Continued.



(d)  $\alpha=55$  to  $90^\circ$  deg,  $SR=0$ .  
Figure A91.-Concluded.

A384

.35

.30

.25

.20

.15

.10

.05

0

-.05

-.10

-.15

-.20

-.25

$C_L$

$\alpha, \text{ deg}$

0 8

10

12

14

16

$(h/2V)$

-.8

-.7

-.6

-.5

-.4

-.3

-.2

-.1

0

.1

.2

.3

.4

.5

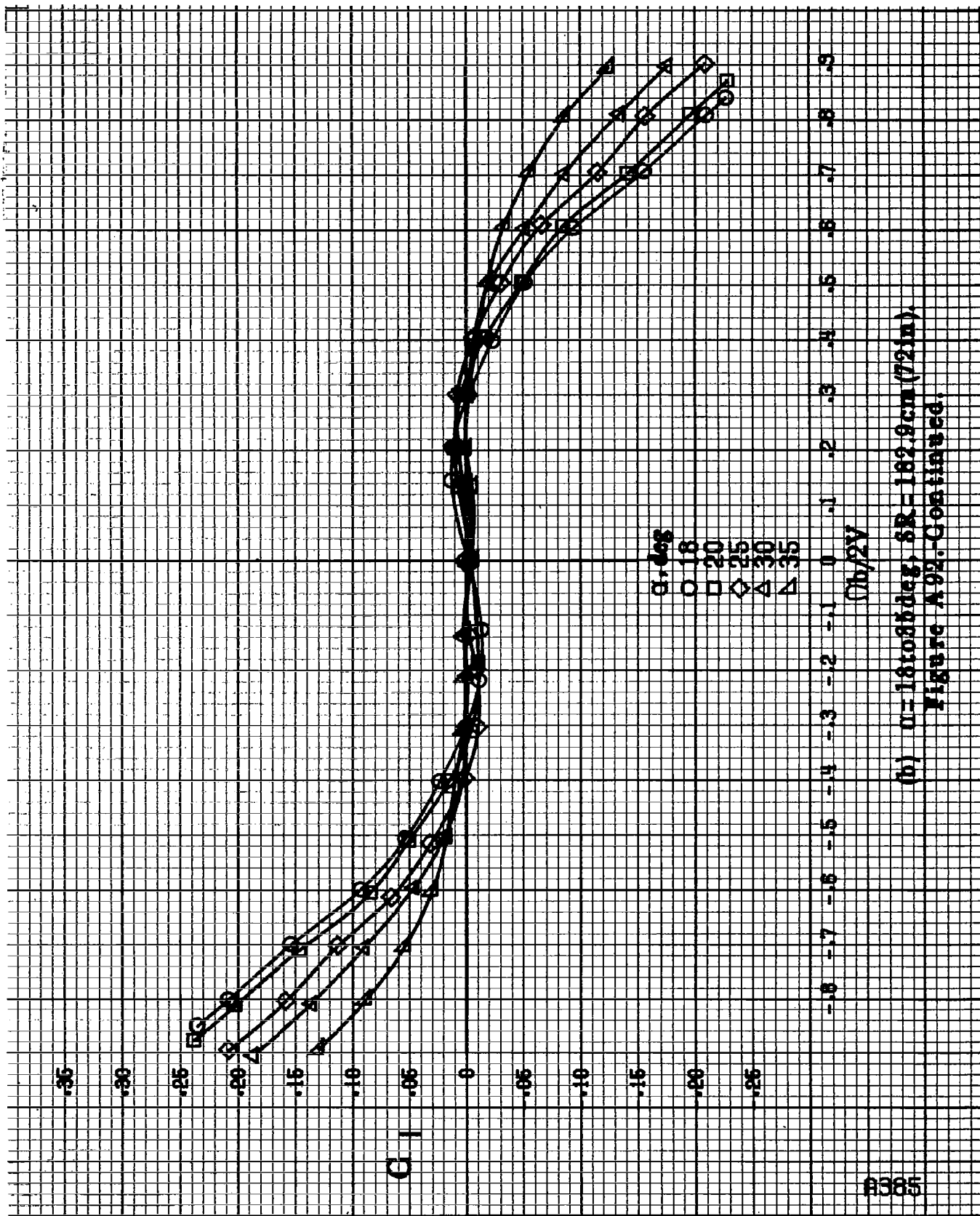
.6

.7

.8

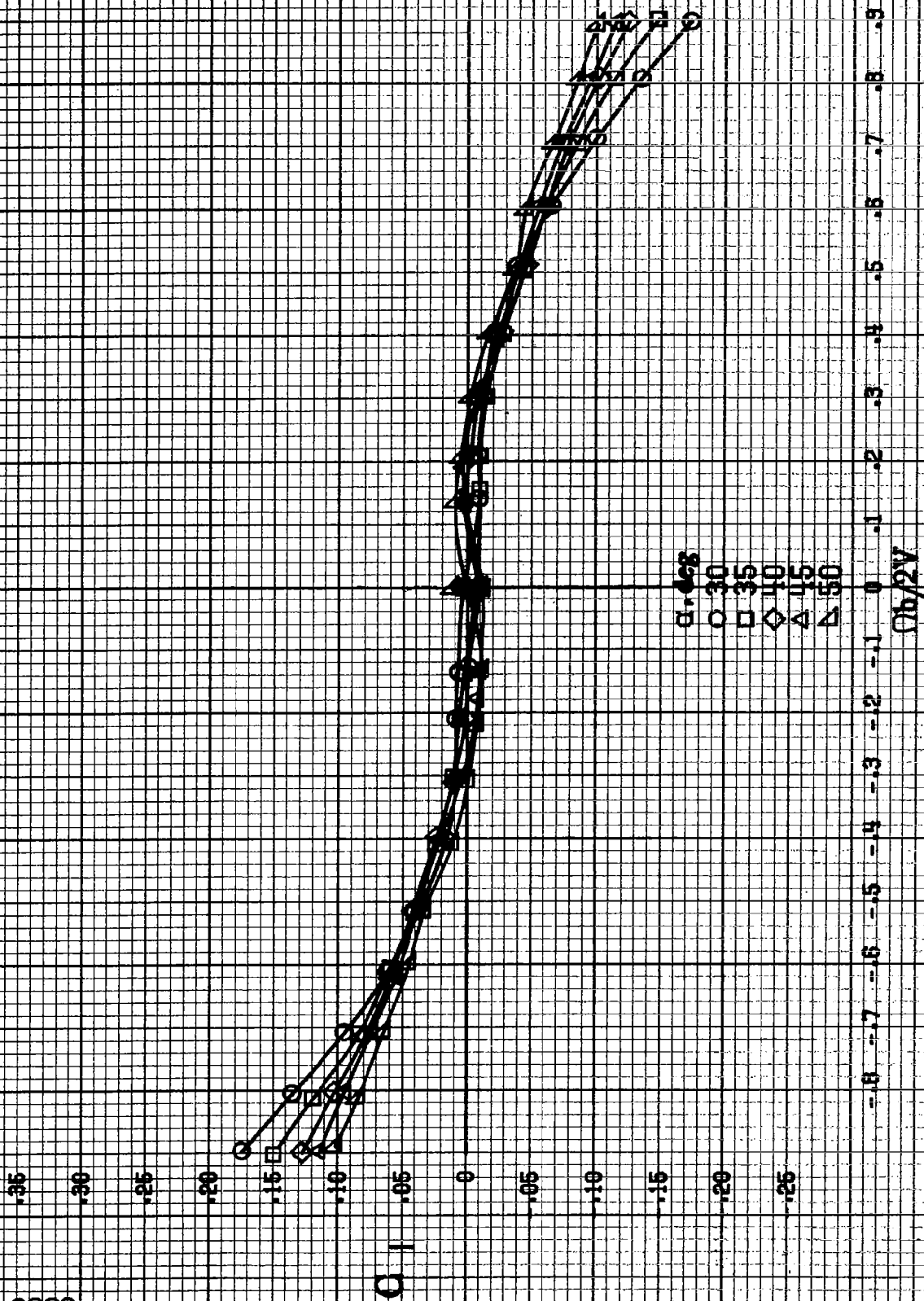
(a)  $\alpha = 86.16 \text{ deg}$ ,  $SR = 182.9 \text{ cm} (72 \text{ in})$ .

Figure A92. Effect of rotation rate and angle of attack on rolling-moment coefficient for vertical tail off configuration.  $\delta_a = 0^\circ$ ,  $\delta_r = 0^\circ$ ,  $\beta = 10^\circ$ .

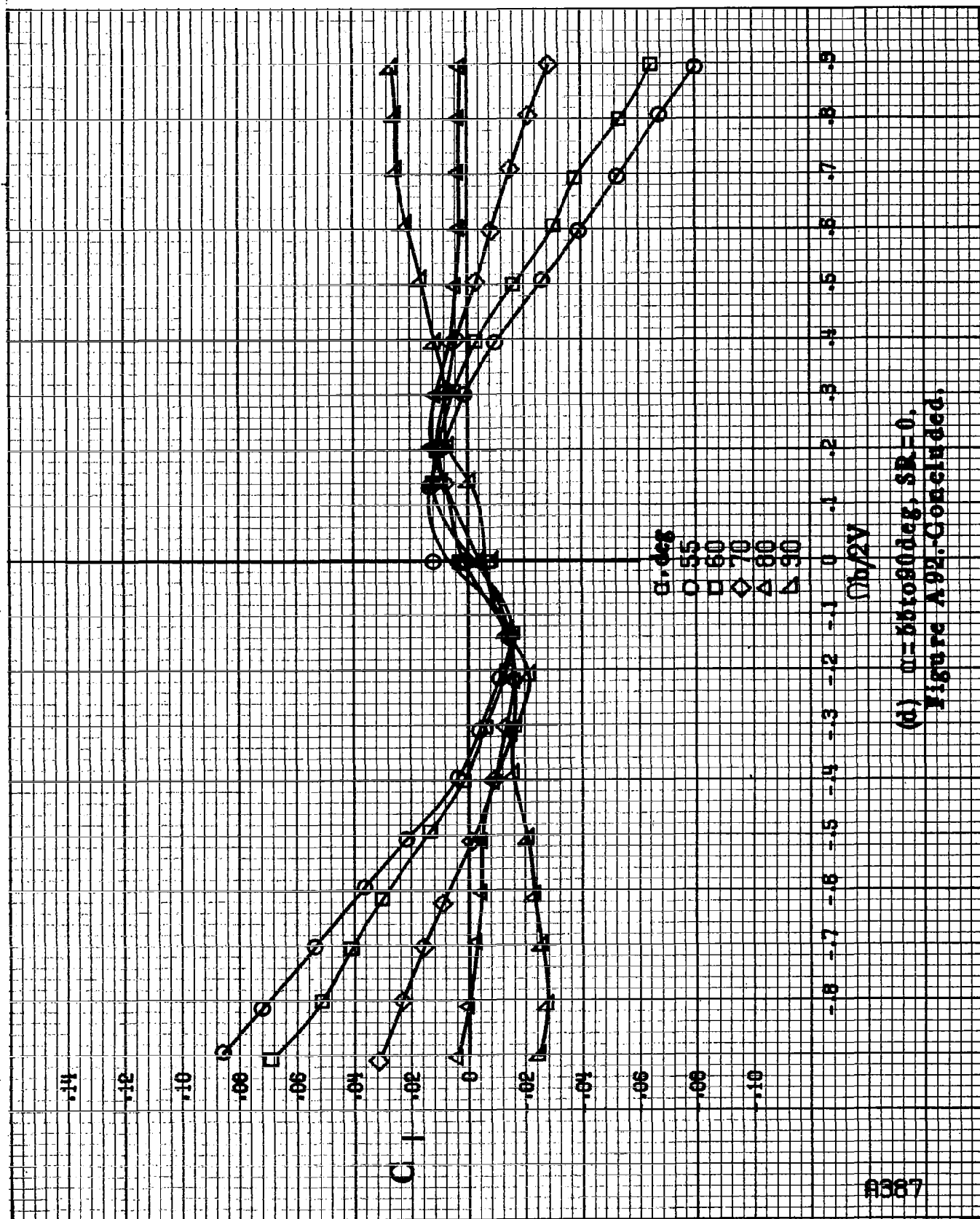


(b)  $\alpha = 18$  to  $35^\circ$ ,  $SR = 182.9 \text{ cm (72 in.)}$ .  
Figure A.92.-Continued.

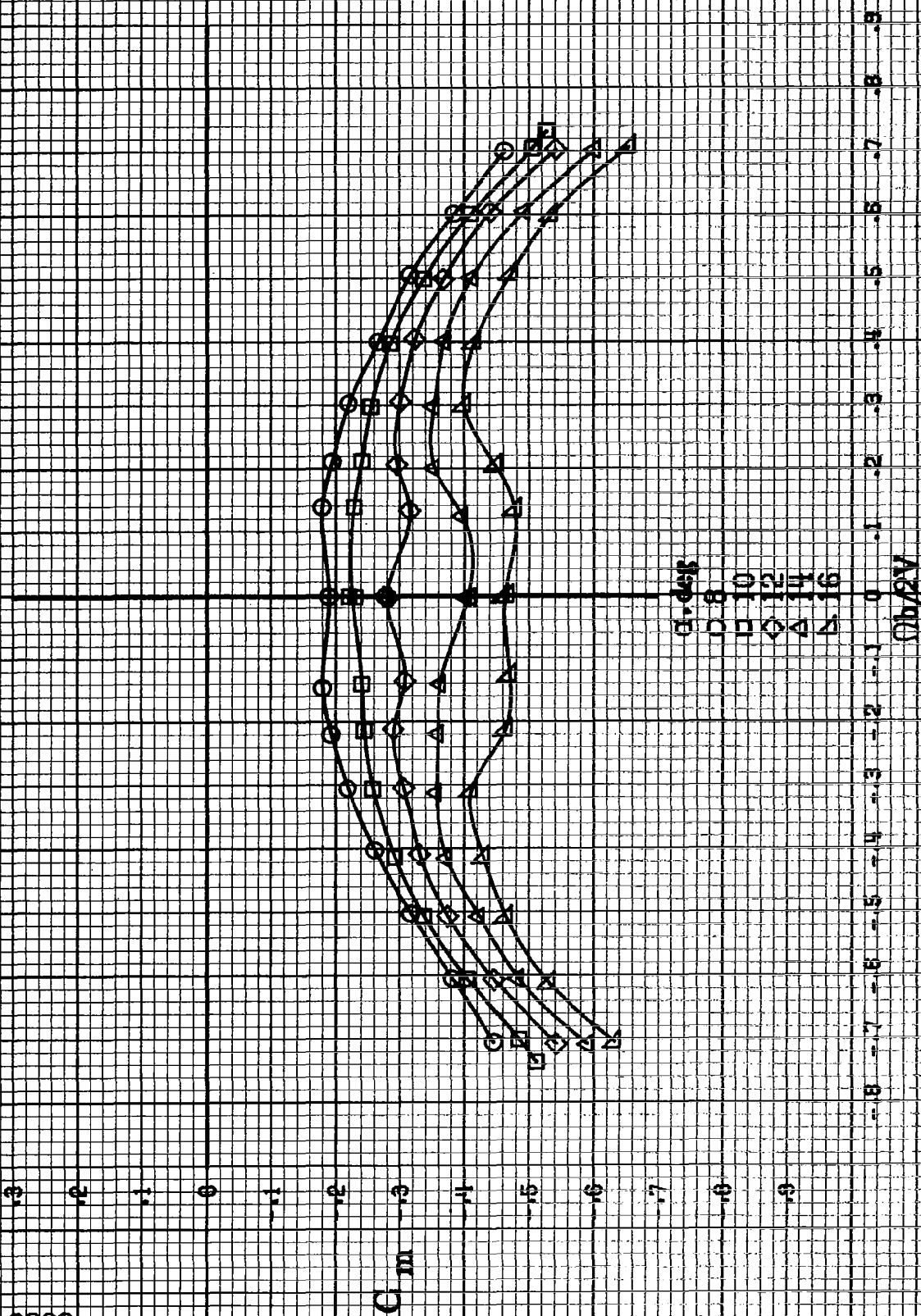
B386



(c)  $\omega = 80 \text{ to } 50 \text{ deg}$ ,  $SR = 0$ ,  
Figure A92.-Continued.



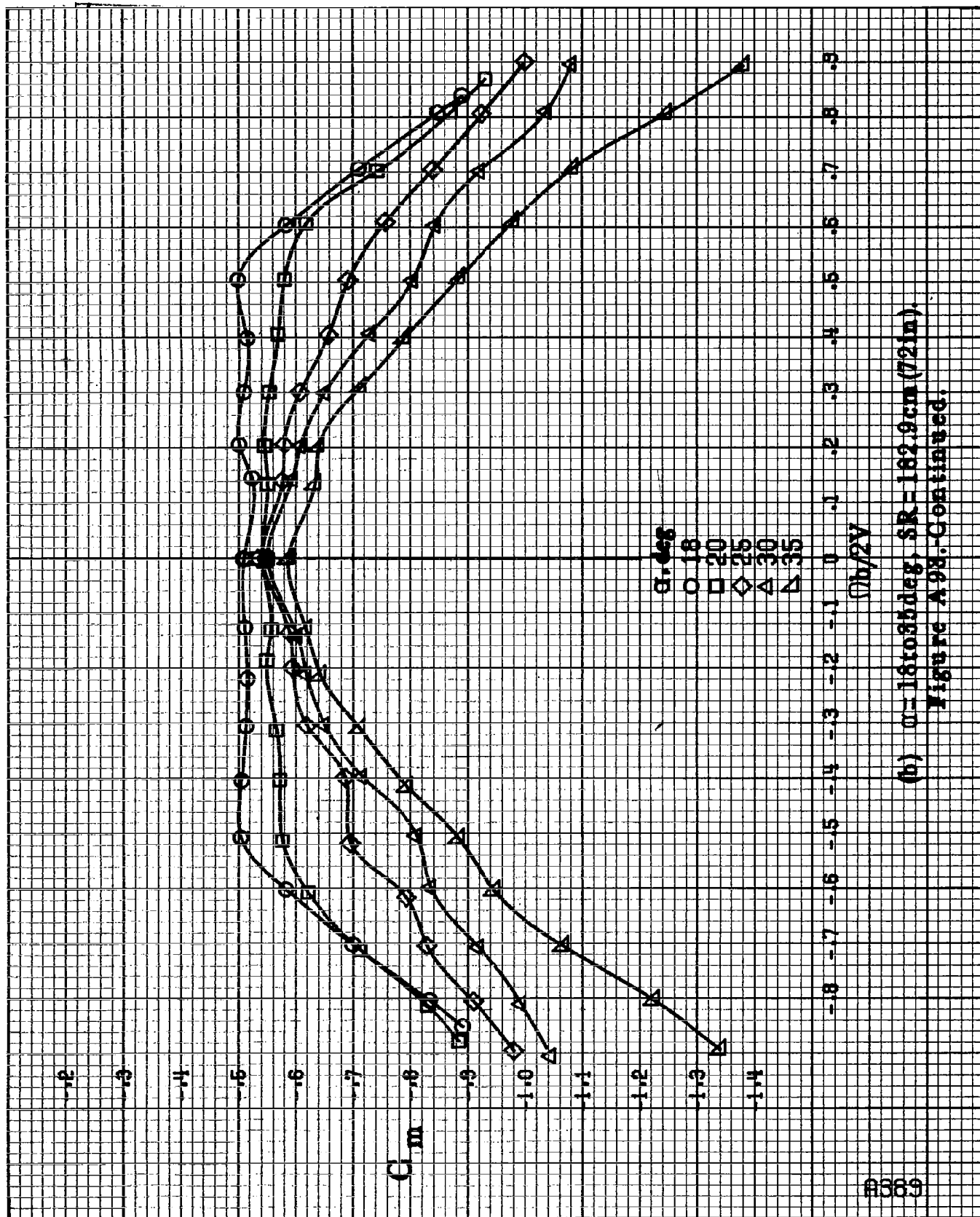
(d)  $\alpha = 86.080^\circ$ ,  $SR = 0$ .  
Figure A 92. Concluded.



(a)  $\alpha = 8$  to  $16^\circ$ ,  $SR = 192.9$  cm (72 in.).

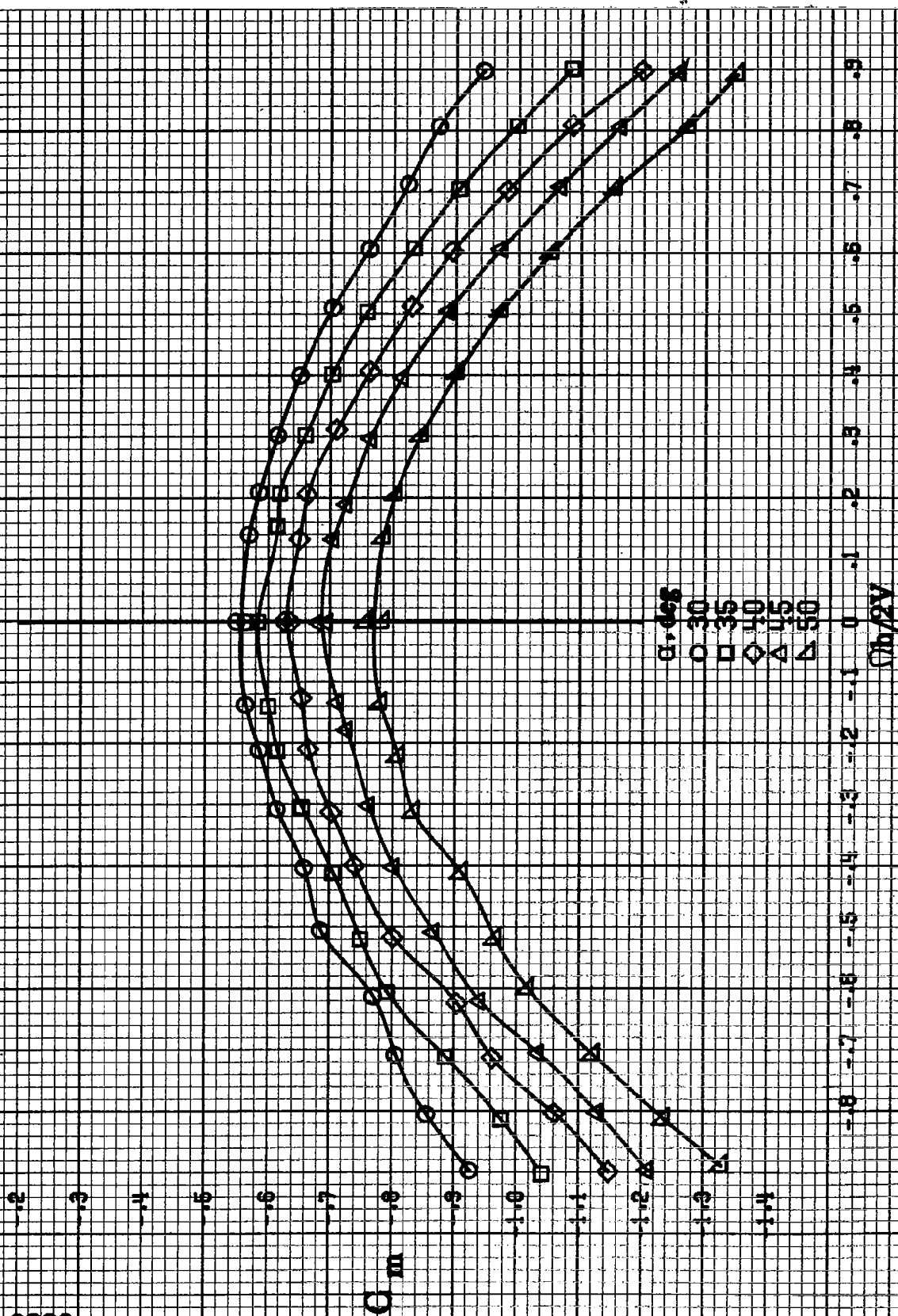
Figure A93. Effect of rotation rate and angle of attack on pitching moment coefficient for vertical tail off configuration.  $\delta_1 = 0^\circ$ ,  $\delta_2 = 0^\circ$ ,  $\delta = 0^\circ$ .



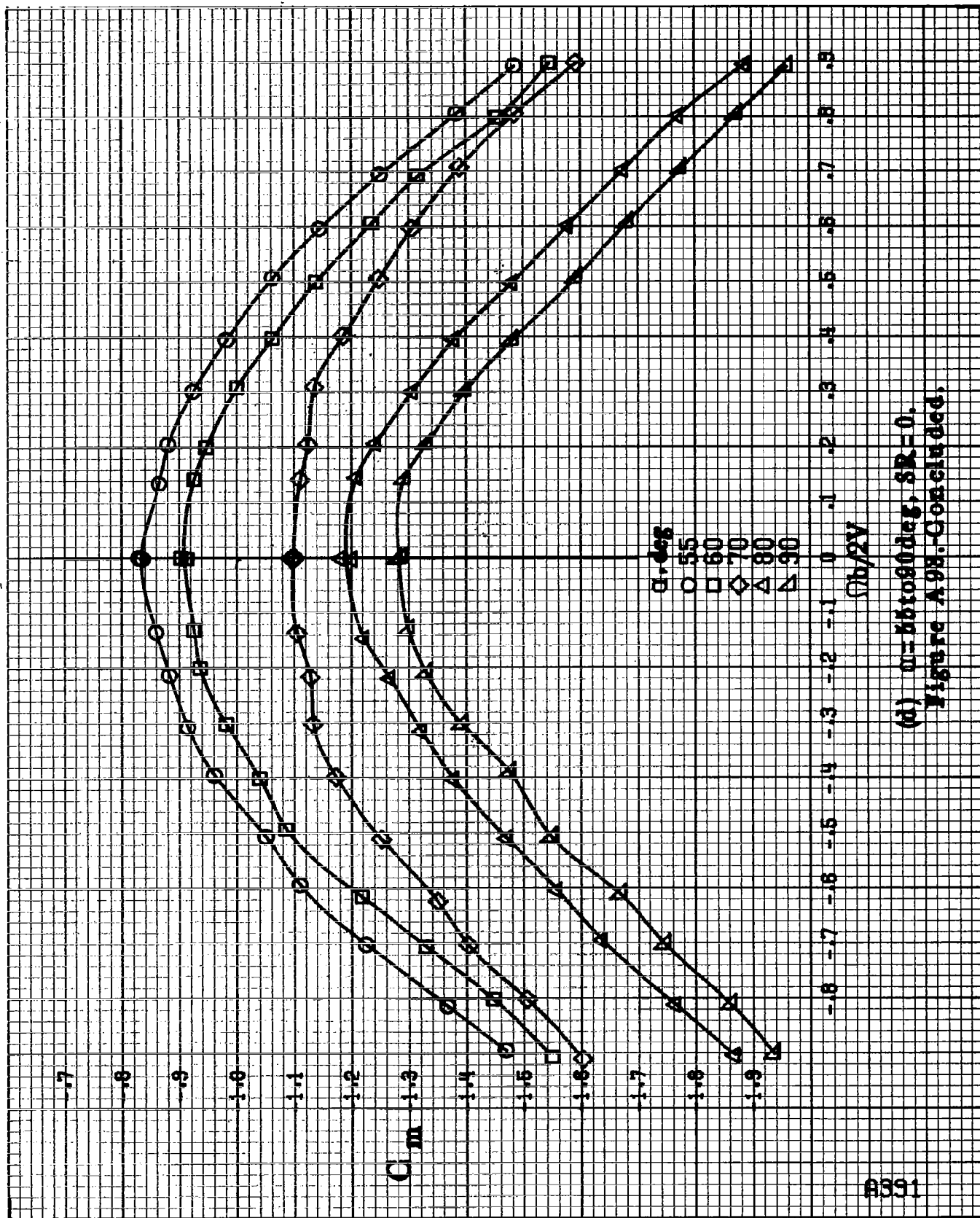


(b)  $\alpha = 18$  to  $35$  deg,  $SR = 162.9$  cm (72 in).  
Figure A 93. Continued.

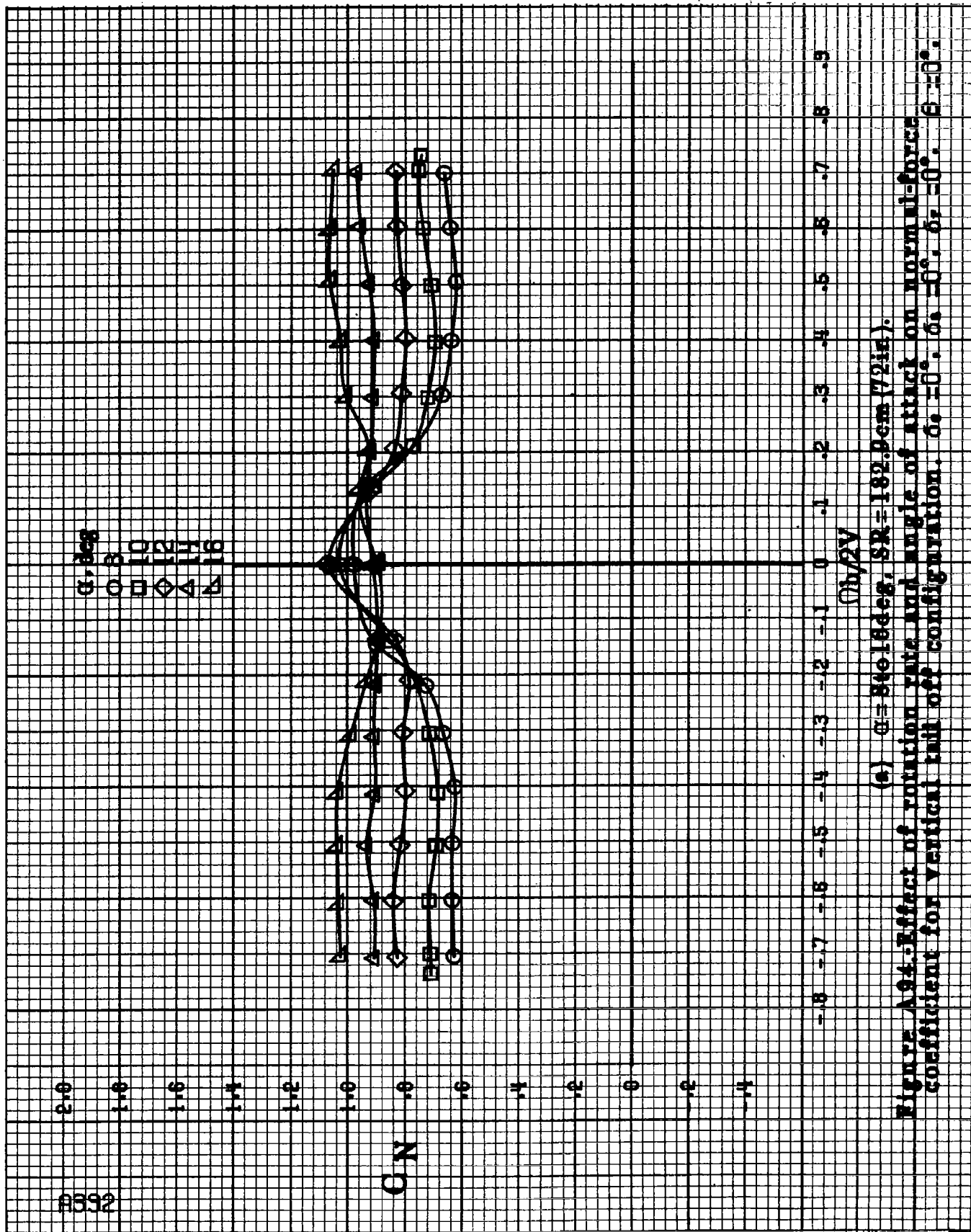
A390



(c)  $\alpha = 80$  to  $80$  deg,  $SR = 0$ ,  
Figure A98-Continued.

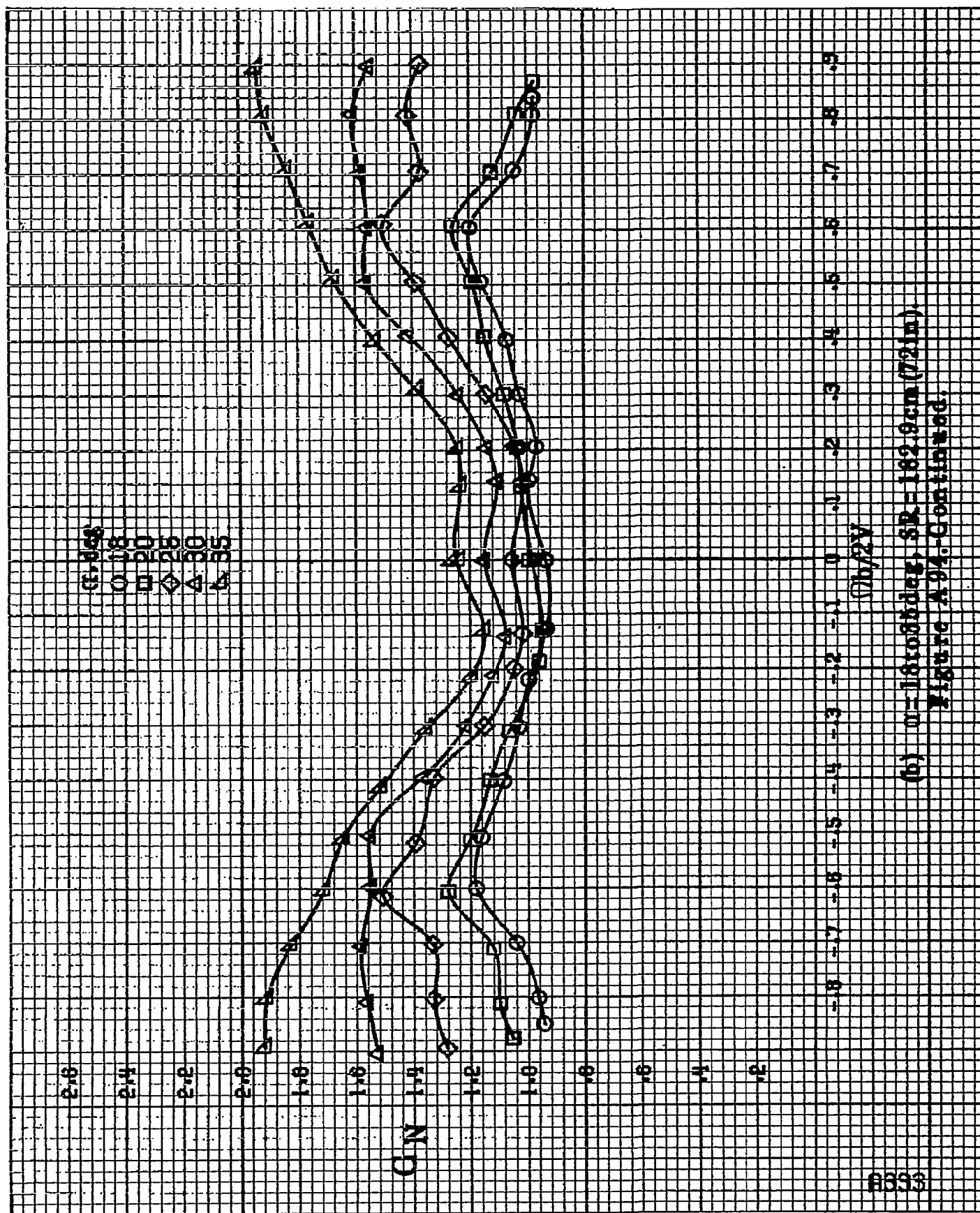


(d)  $m=26$  to  $90^\circ$ ,  $SR=0$ .  
Figure A98-Continued.

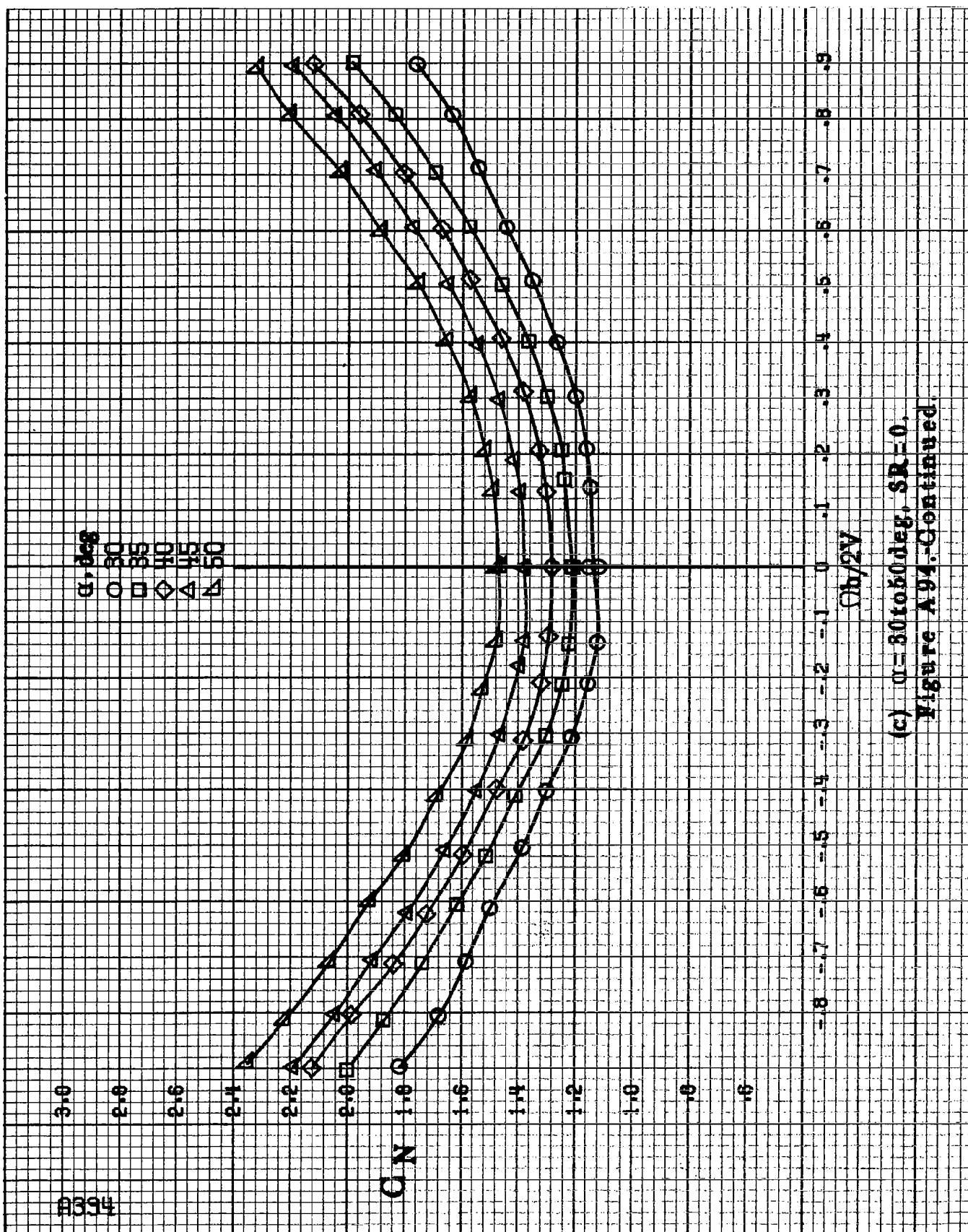


(a)  $\alpha = 84.618^\circ$ ,  $SR = 182.9 \text{ cm} (72 \text{ in})$ .

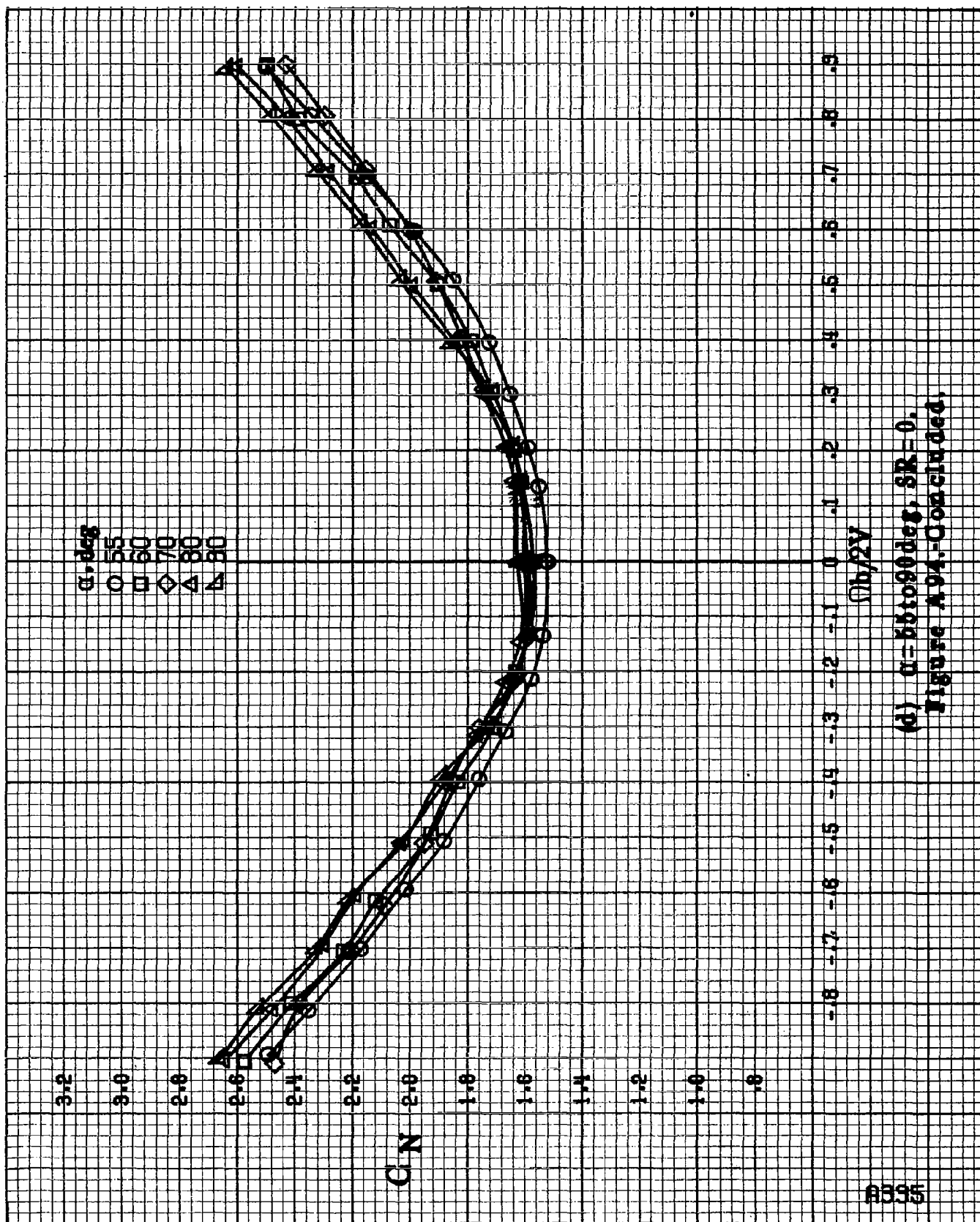
Figure A94-Effect of rotation rate and angle of attack on normal force coefficient for vertical tail off configuration.  $\alpha = 0^\circ, 5^\circ, 10^\circ, 15^\circ, 20^\circ$ .



(b)  $\alpha=18$  to  $85$  deg,  $SR=182.9$  cm (72 in).  
Figure A 94-Continued.



(c)  $\alpha = 30$  to  $50$  deg,  $SR = 0$ .  
Figure A94-Continued.



(d)  $\alpha = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A 94.-Concluded.

8336

$\alpha$ , deg  
 8  
 10  
 12  
 14  
 16

$C_Y$

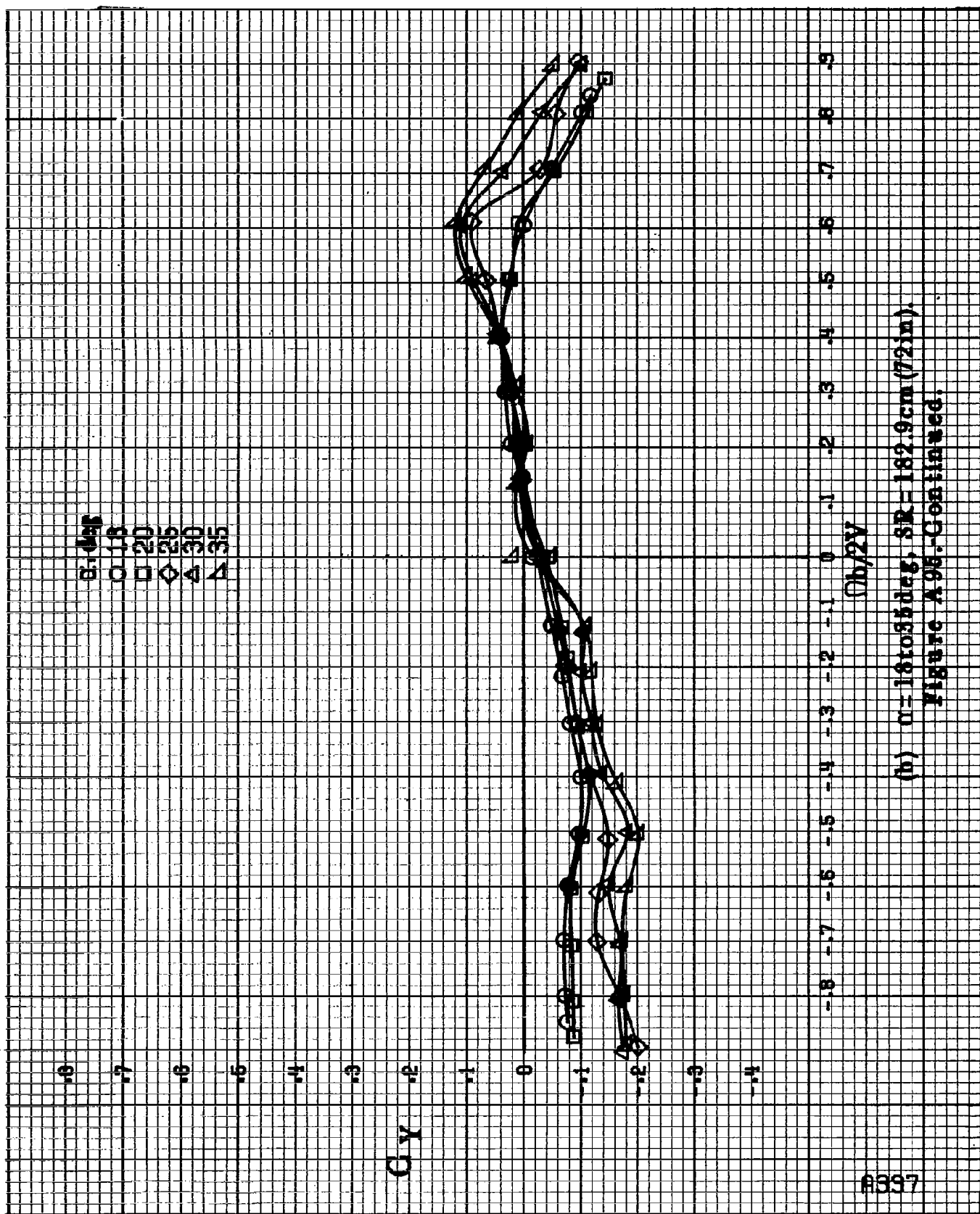


$(b/2V)$

(a)  $\alpha=8$  to  $16^\circ$ ,  $SR=1.92$  sem (72 in).

Figure A33. Effect of rotation rate and angle of attack on side-force coefficient for vertical tail off configuration.  $\delta_1=0^\circ$ ,  $\delta_2=0^\circ$ ,  $\theta=0^\circ$ .





(b)  $\alpha = 16.035 \text{ deg}$ ,  $SR = 182.9 \text{ cm}$  (72 in).  
Figure A95-Continued.

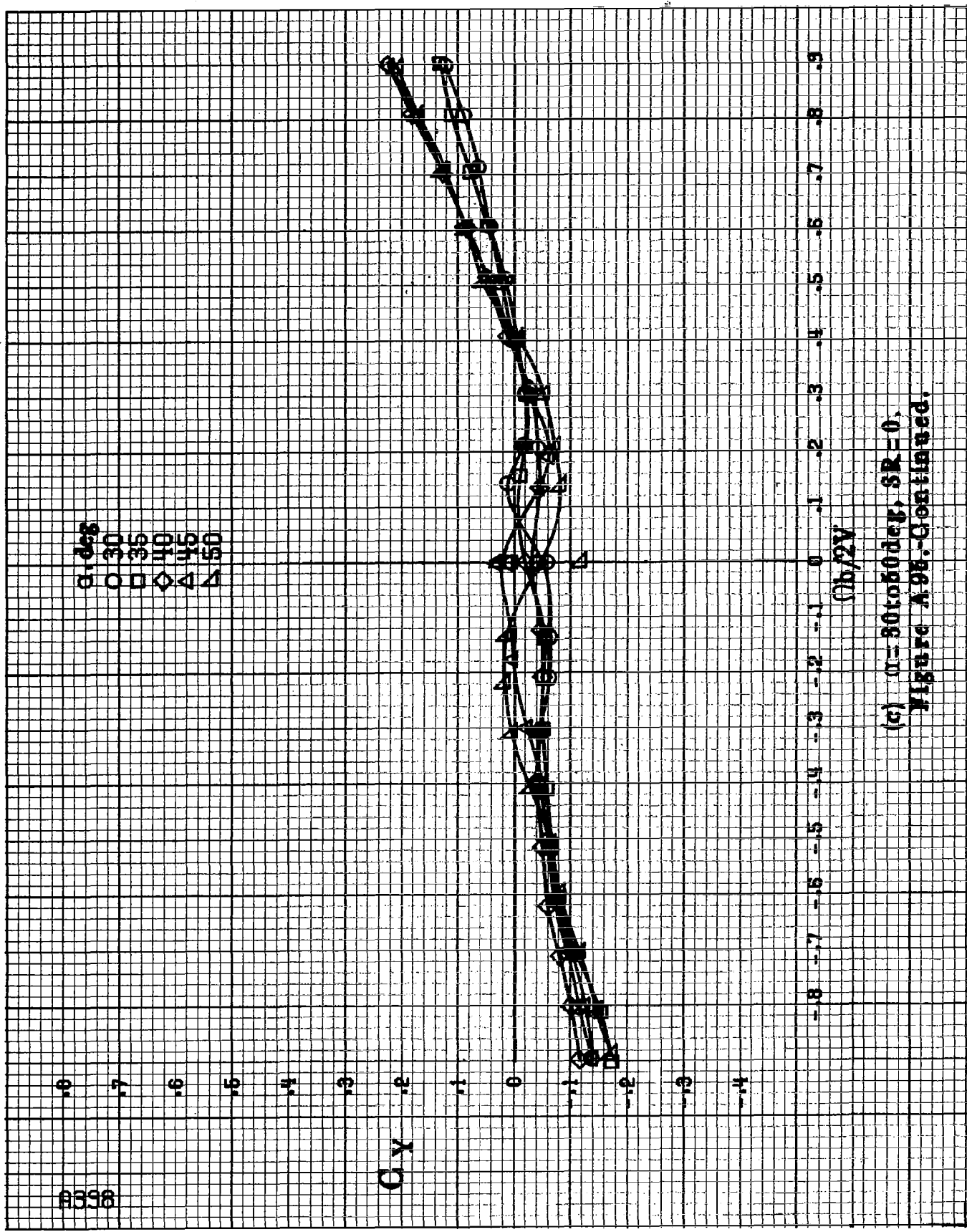
8398

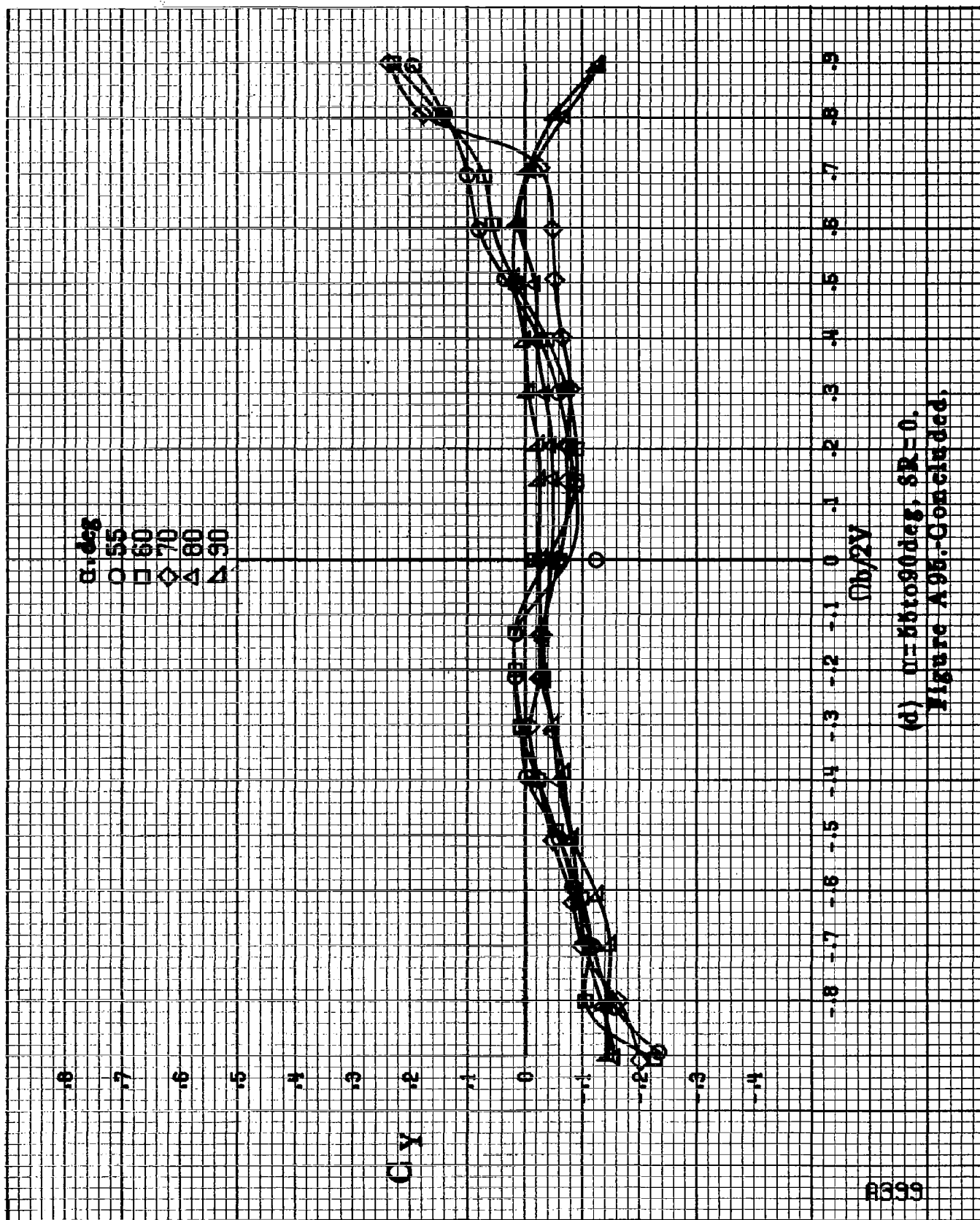
$\alpha, \text{deg}$   
 $\circ$  30  
 $\square$  35  
 $\diamond$  40  
 $\triangle$  45  
 $\nabla$  50

$C_x$

$\alpha b/2V$

(c)  $\alpha = 30$  to  $50 \text{ deg}$ ,  $SR = 0$ ,  
 Figure A98-Continued.



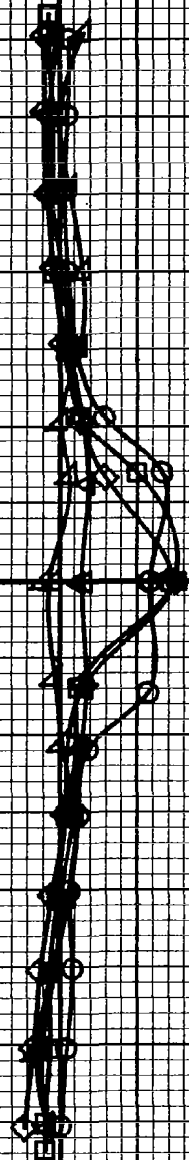


(d)  $\alpha = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A 95.-Concluded.

00400

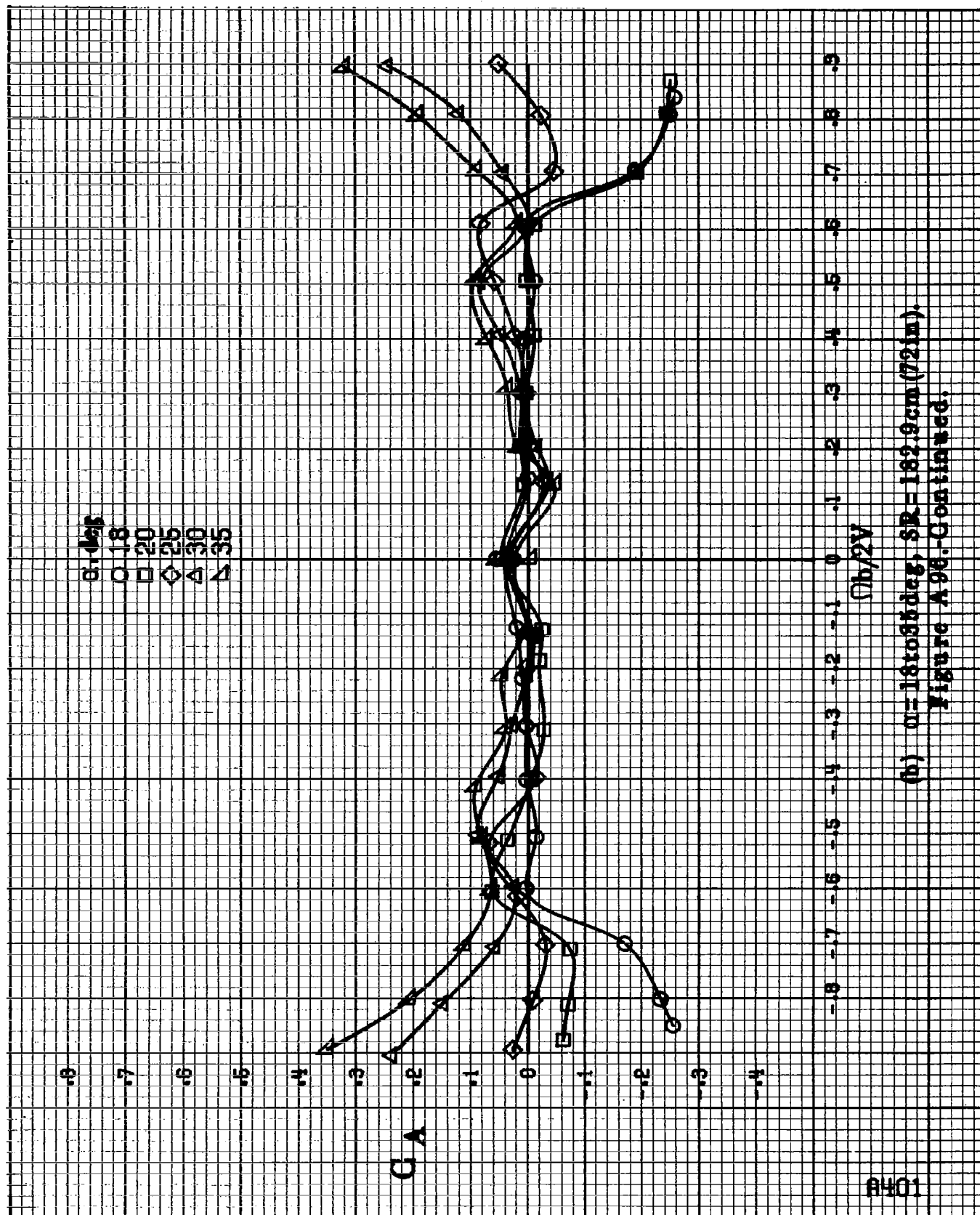
$\alpha, \text{deg}$   
 $\circ 8$   
 $\square 10$   
 $\diamond 12$   
 $\triangle 14$   
 $\nabla 16$

CA



$Oh/2V$

(a)  $\alpha = 8$  to  $16$  deg,  $SR = 182.9$  cm (72 in).  
 Figure A.96. Effect of rotation rate and angle of attack on axial force coefficient for vertical tail off configuration.  $\delta_0 = 0^\circ$ ,  $\delta_1 = 0^\circ$ ,  $\delta_2 = 0^\circ$ ,  $\delta = 0^\circ$ .



(b)  $\alpha = 18$  to  $35$  deg,  $SR = 182.9$  cm (72 in).  
Figure A96-Continued.

PH02

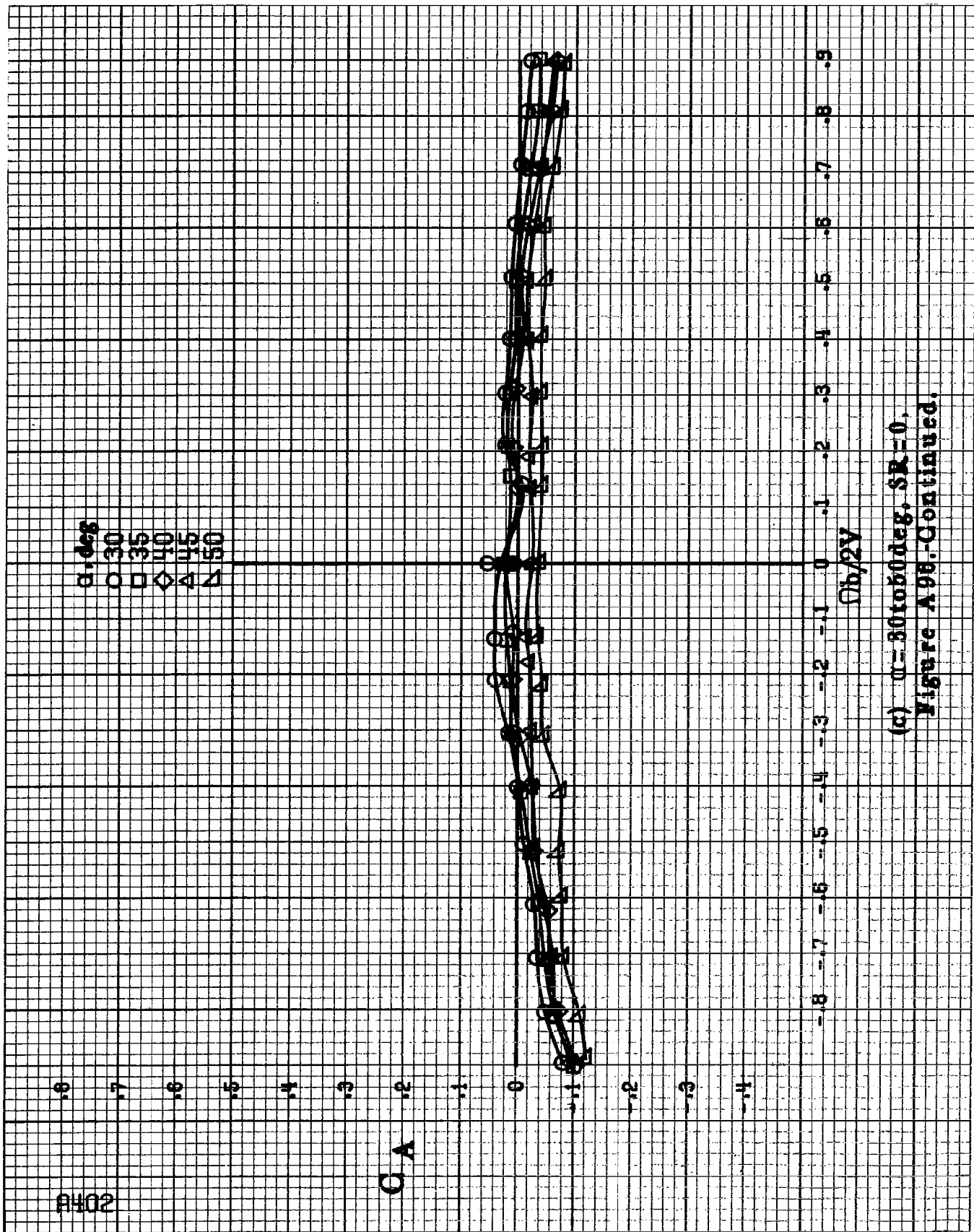
CA

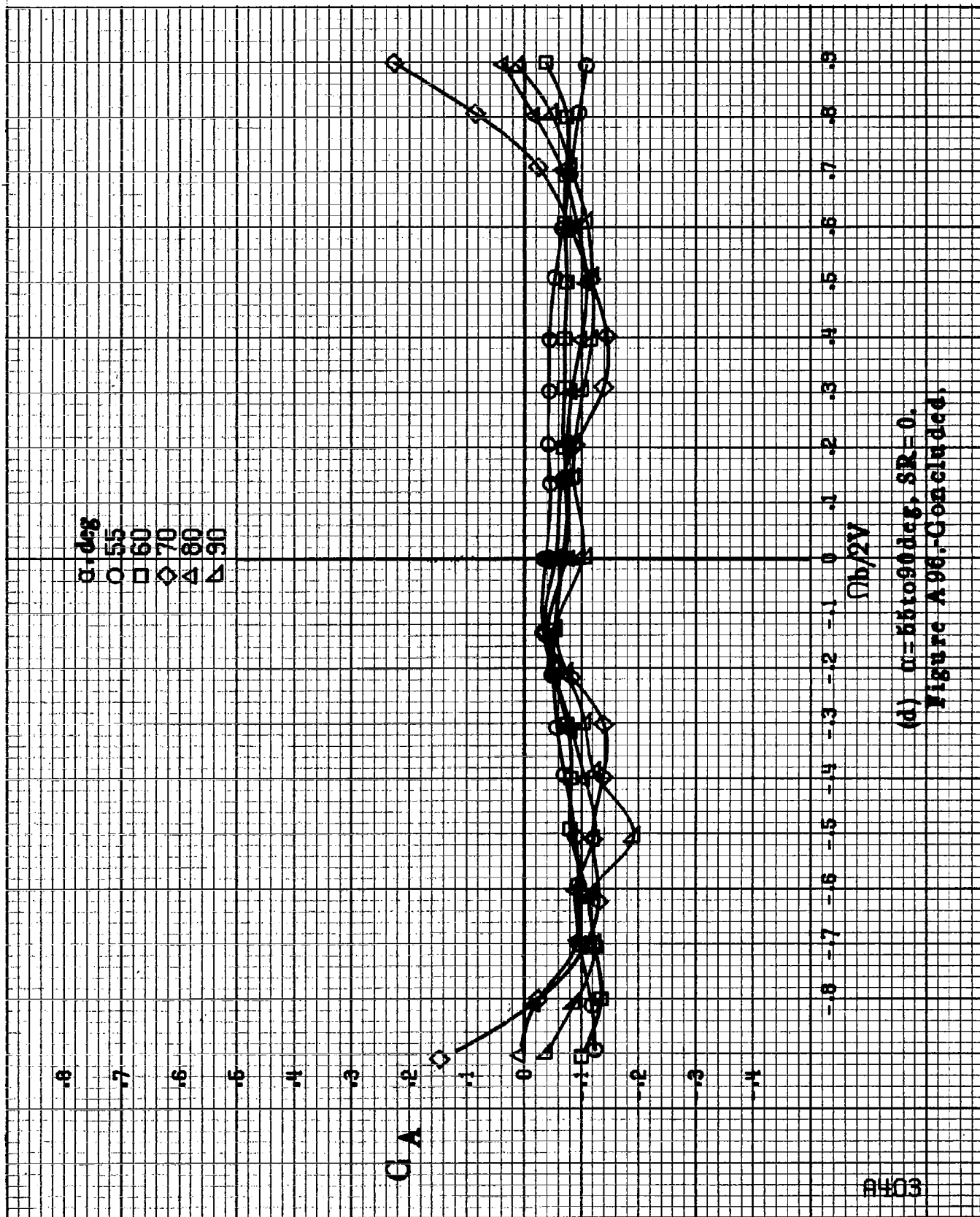
$\alpha, \text{deg}$   
 O 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▽ 50

-0.8 -0.7 -0.6 -0.5 -0.4 -0.3 -0.2 -0.1 0 .1 .2 .3 .4 .5 .6 .7 .8 .9

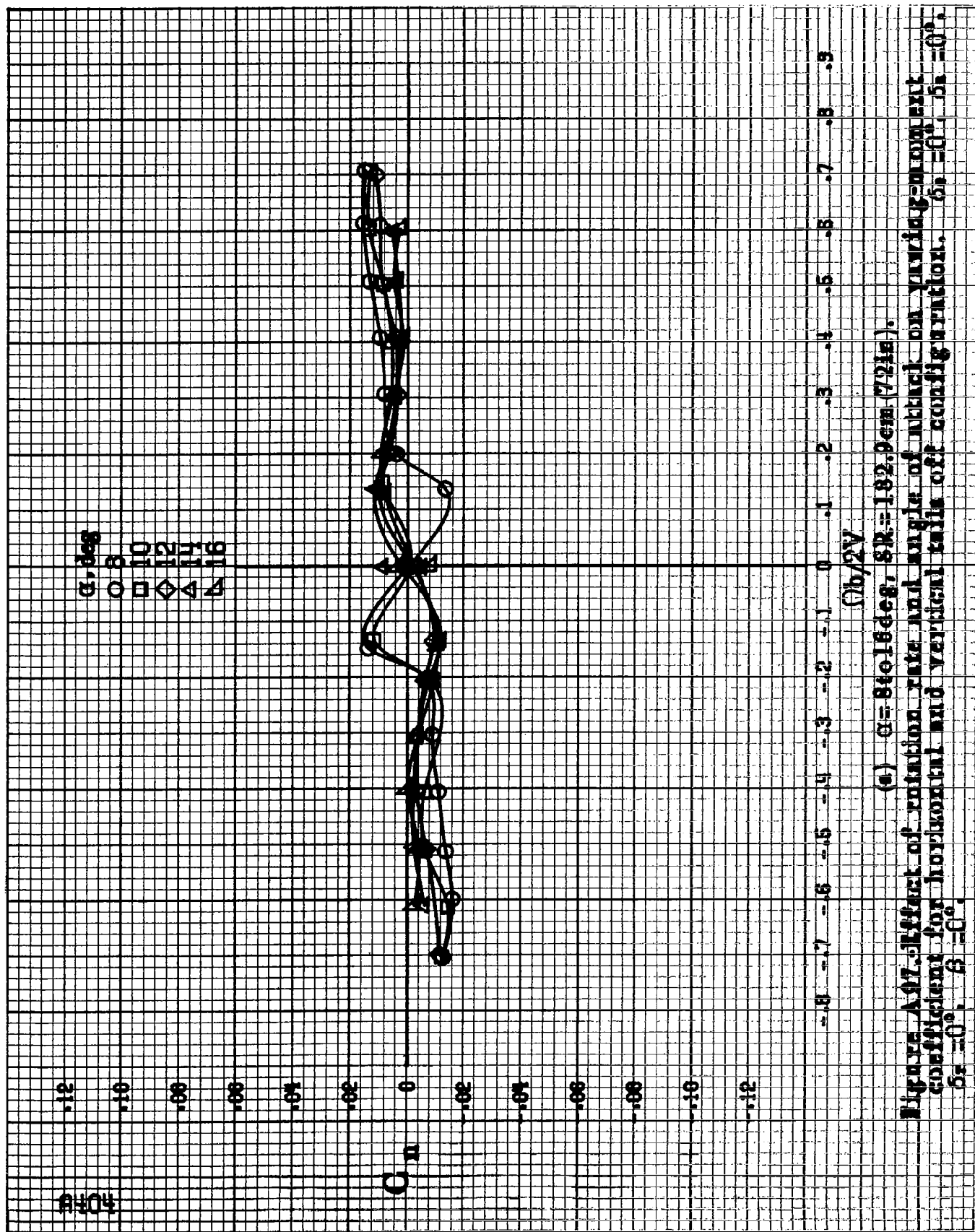
$\phi_b/2V$

(c)  $\alpha = 30 \text{ to } 50 \text{ deg}$ ,  $SR = 0$ .  
 Figure A98, Continued.





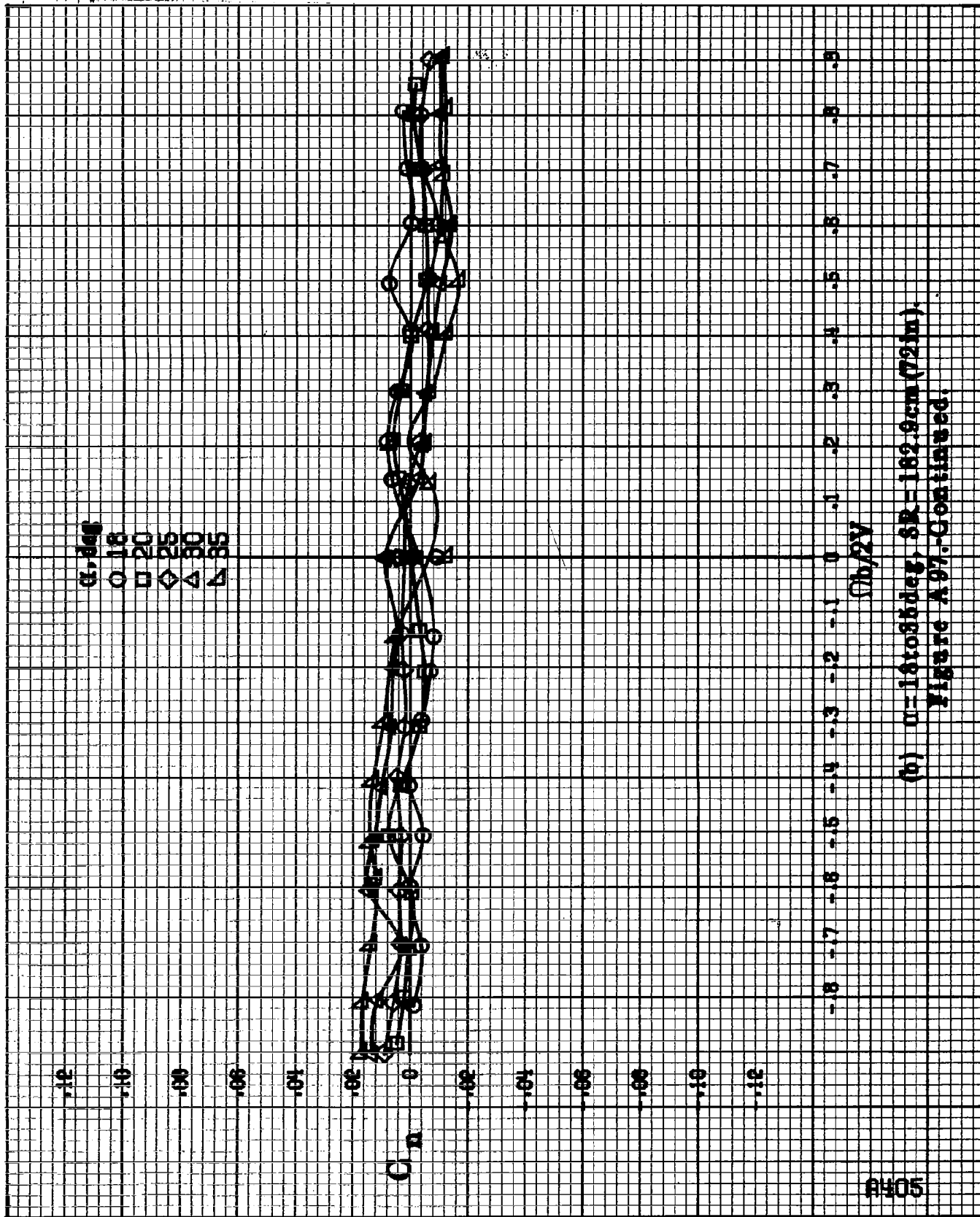
(d)  $\alpha = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A96.-Continued.



(a)  $\alpha = 8$  to  $16$  deg,  $SR = 1.82$ ,  $9$  cm (72 in.).

Figure A97. Effect of rotation rate and angle of attack on yawing moment coefficient for horizontal and vertical tails off configuration.  $\delta_s = 0^\circ$ ,  $\delta_n = 0^\circ$ .





(b)  $\alpha = 15$  to  $35$  deg,  $SR = 182.9$  cm (72 in).  
Figure A 97-Continued.

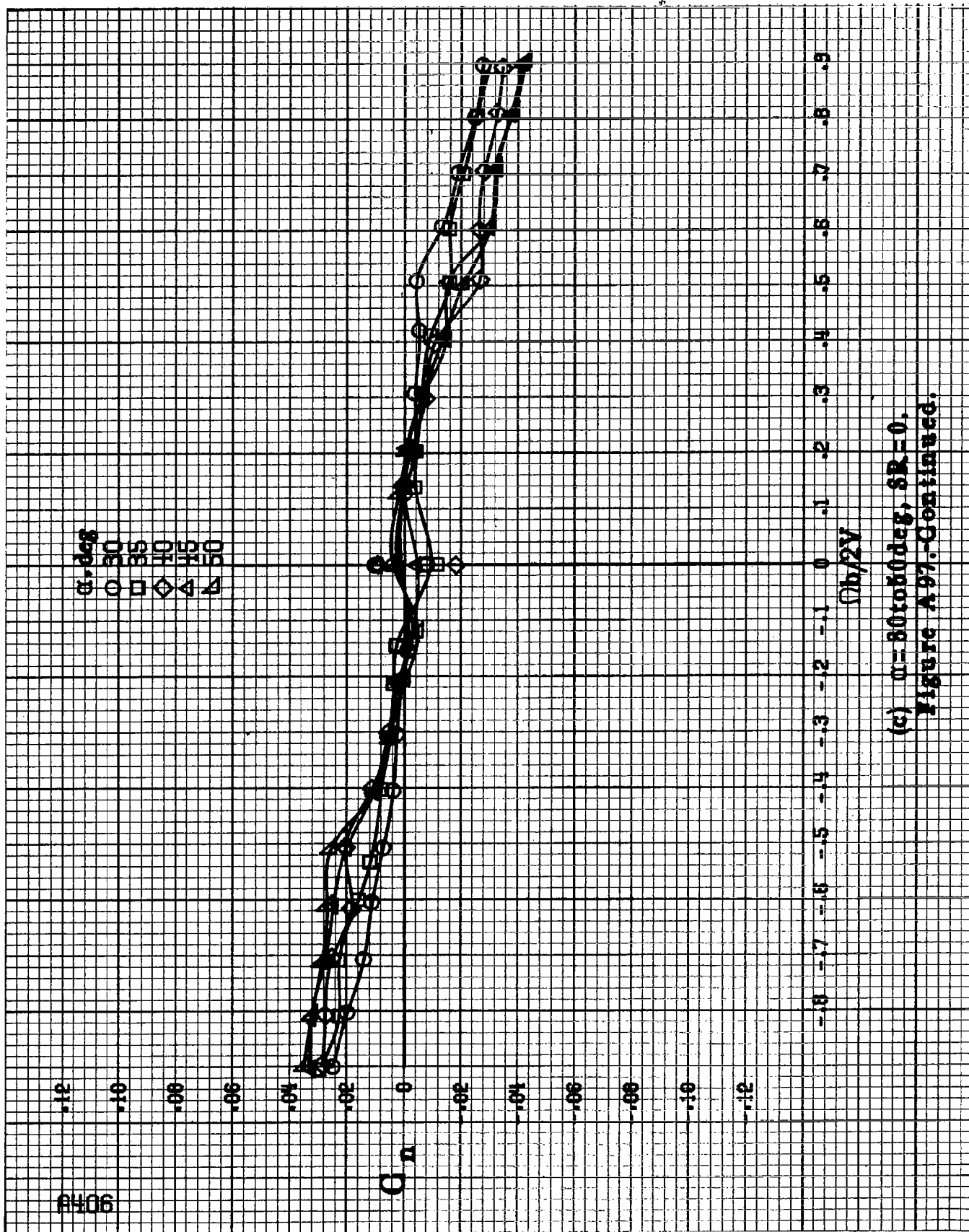
A406

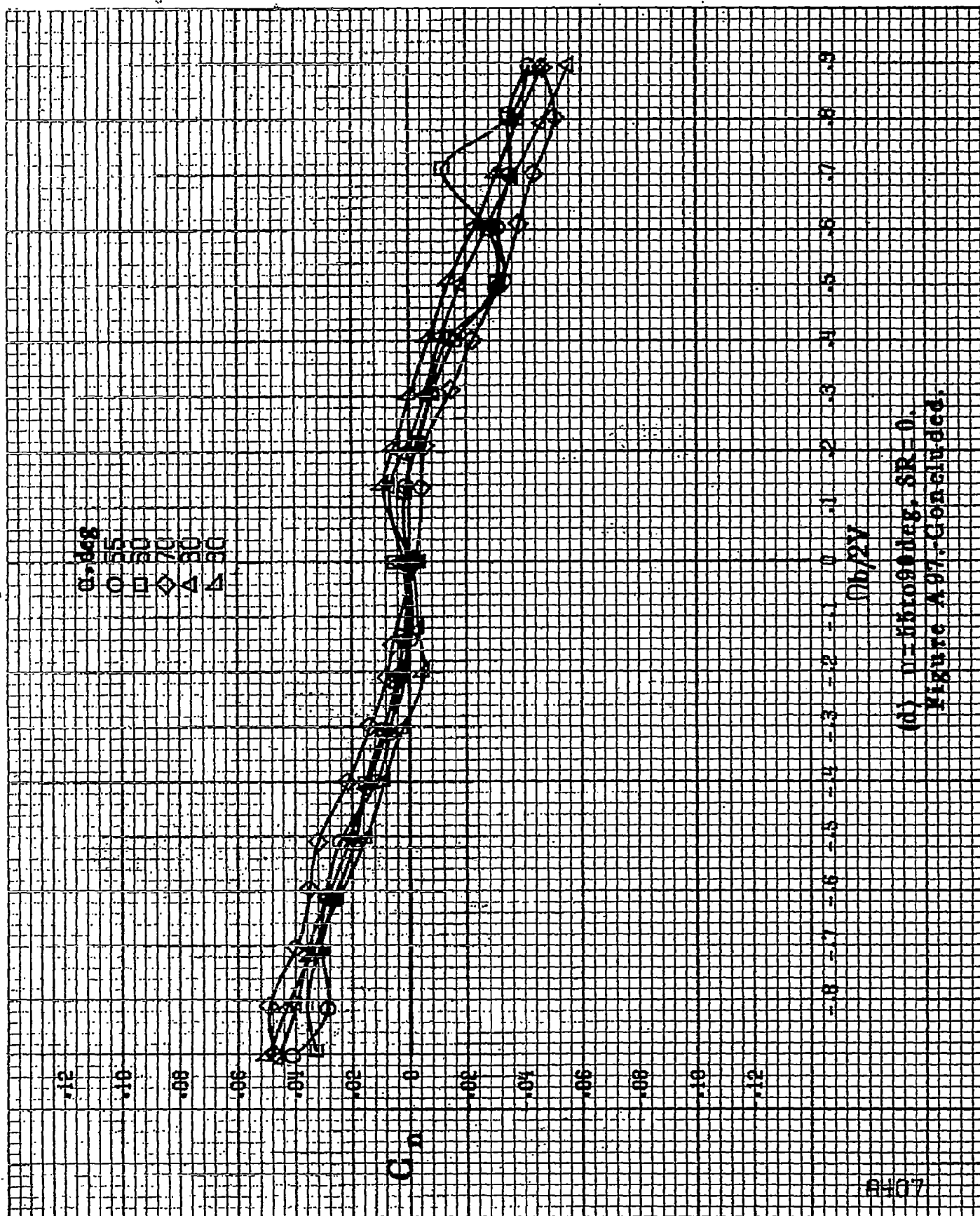
$\alpha, \text{deg}$   
 30  
 35  
 40  
 45  
 50

$C_n$

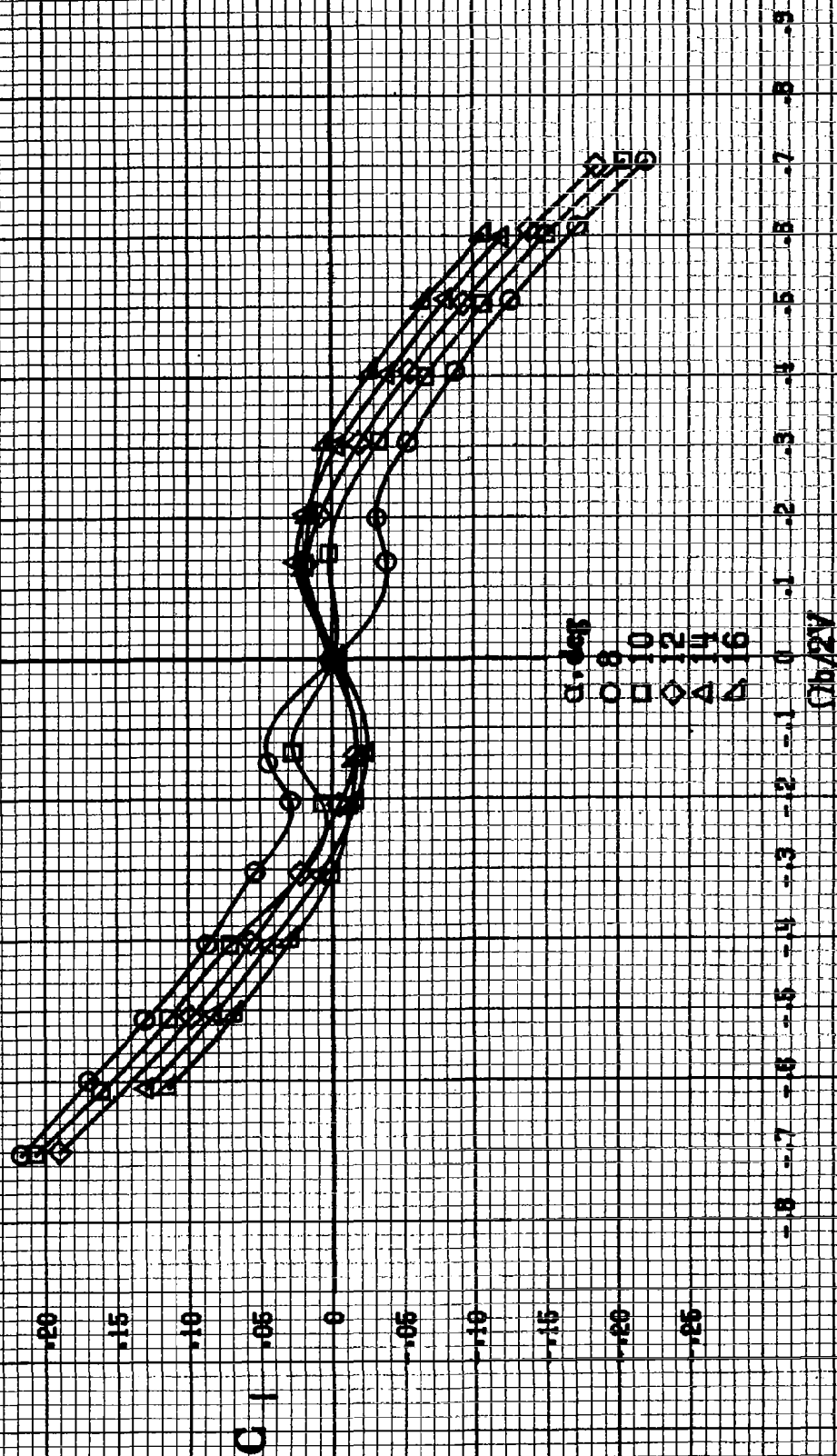
$\alpha_b/2V$

(c)  $\alpha=80$  to  $90$  deg,  $\delta R=0$ .  
 Figure A 97-Continued.



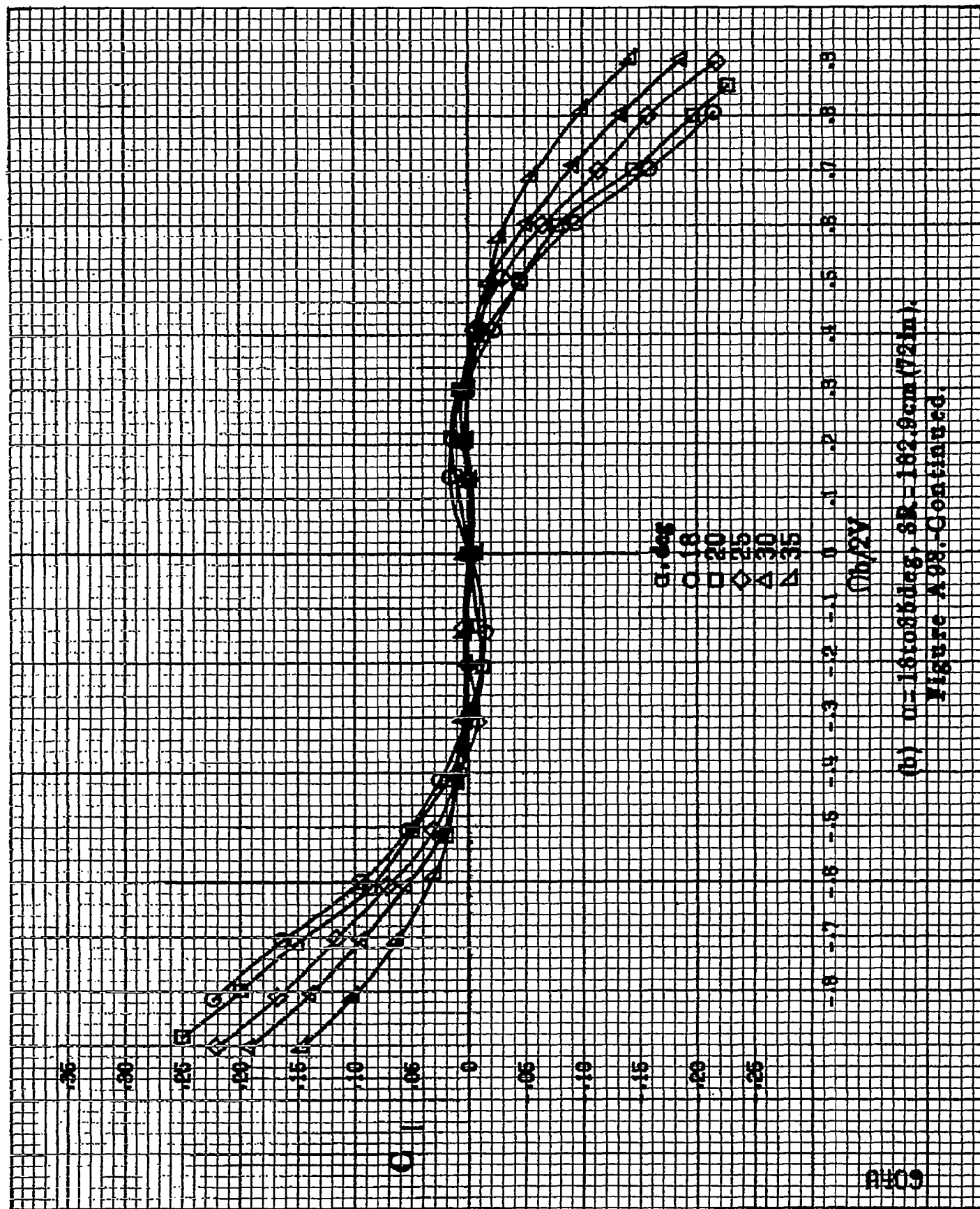


(d)  $\mu = 0.009 \text{ day}$ ,  $SR = 0$ .  
Figure A.97.-Concluded.



(a)  $\alpha = 8$  to  $18^\circ$ ,  $SR = 1.02, 9 \text{ cm} (72 \text{ in})$ .

Figure A98. Effect of rotation rate and angle of attack on rolling moment coefficient for horizontal and vertical tails off configuration.  $\delta_r = 0^\circ$ ,  $\delta_a = 0^\circ$ ,  $\delta_s = 0^\circ$ ,  $\beta = 0^\circ$ .



(b)  $\alpha = 16$  to  $35$  deg,  $SR = 182.9 \text{ cm (72 in.)}$ .

Figure A98. Continued.

0509

R410

.35

.30

.25

.20

.15

.10

.05

0

-.05

-.10

-.15

-.20

-.25

$C_1$

$\alpha, \text{deg}$

○ 30

□ 35

◇ 40

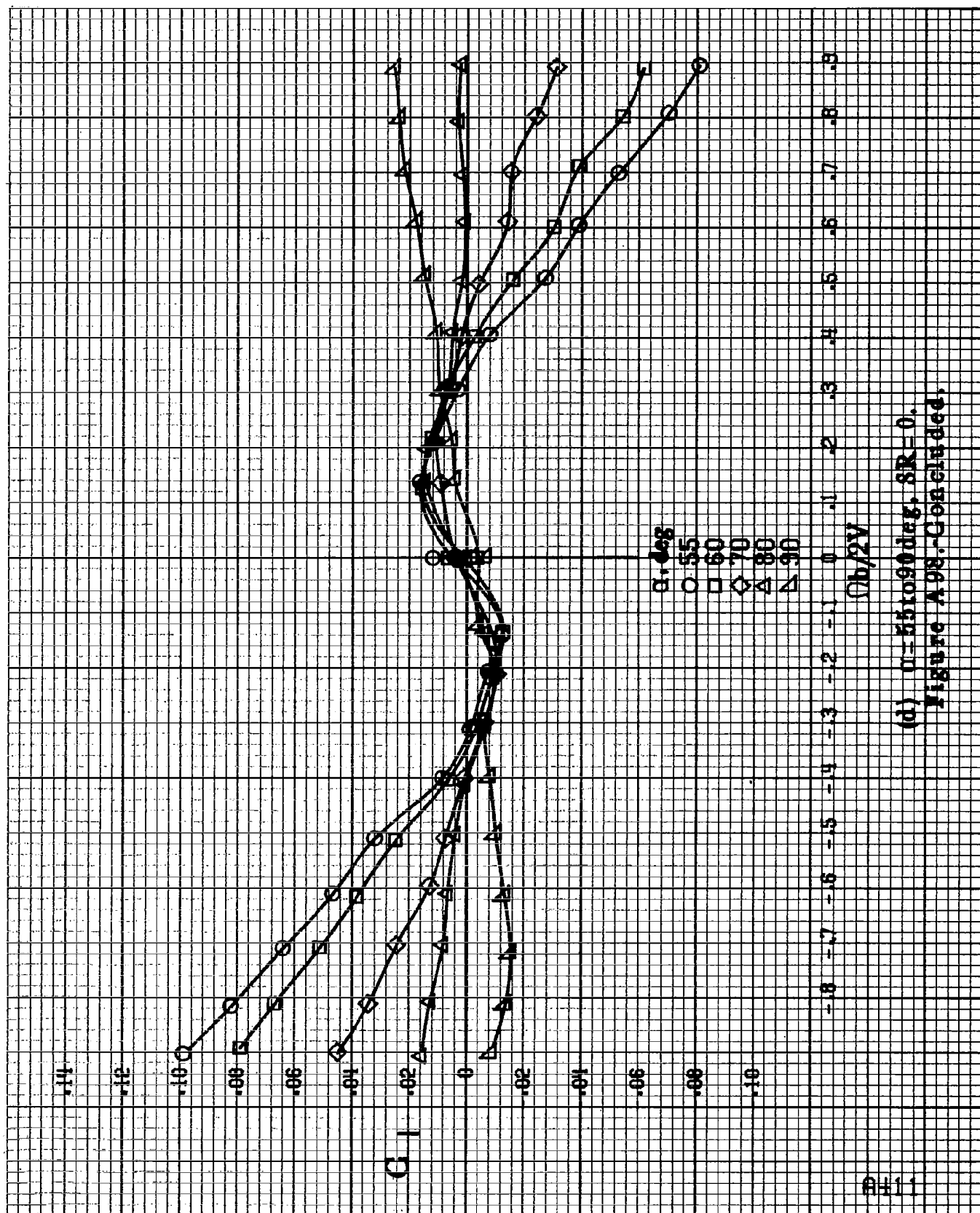
△ 45

△ 50

$\Omega b/2V$

-1.0 -0.7 -0.6 -0.5 -0.4 -0.3 -0.2 -0.1 0 .1 .2 .3 .4 .5 .6 .7 .8 .9

(c)  $\alpha=80$  to  $60$  deg,  $SR=0$ ,  
Figure A98-Continued.



(d)  $\alpha = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A98.-Concluded.

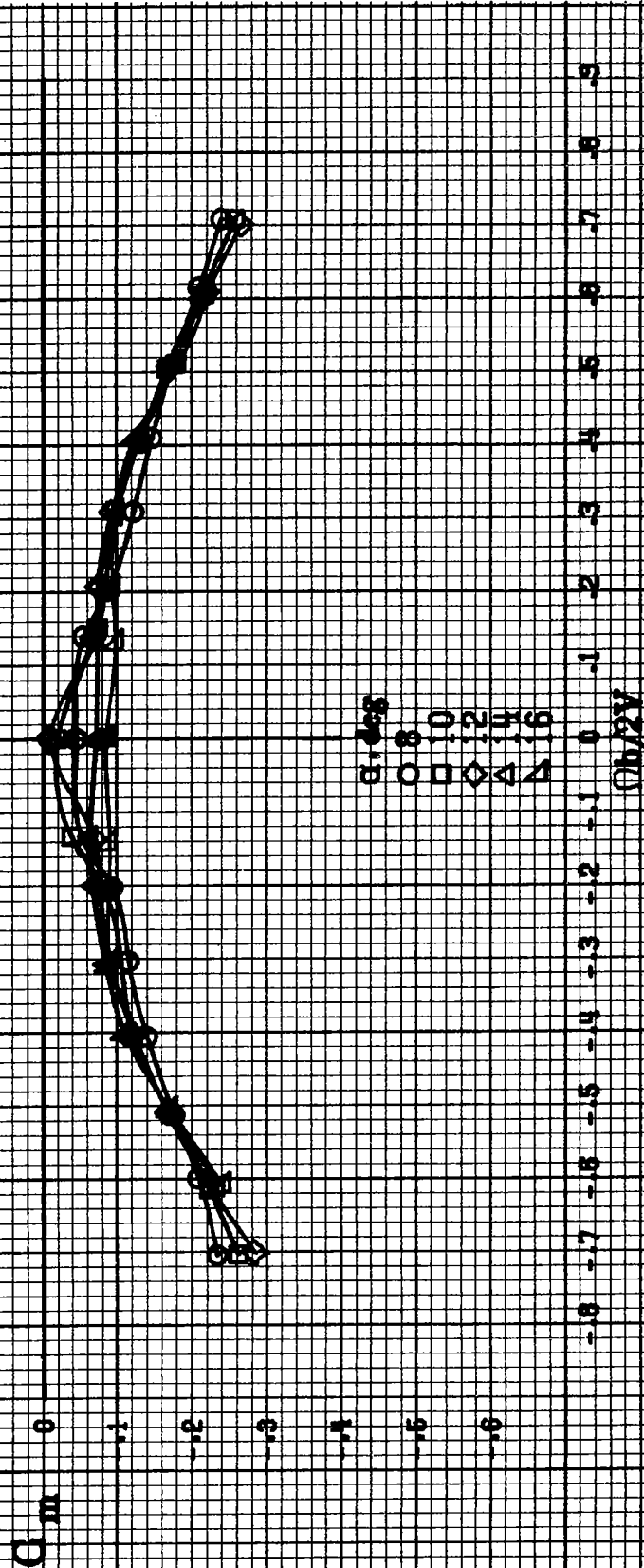
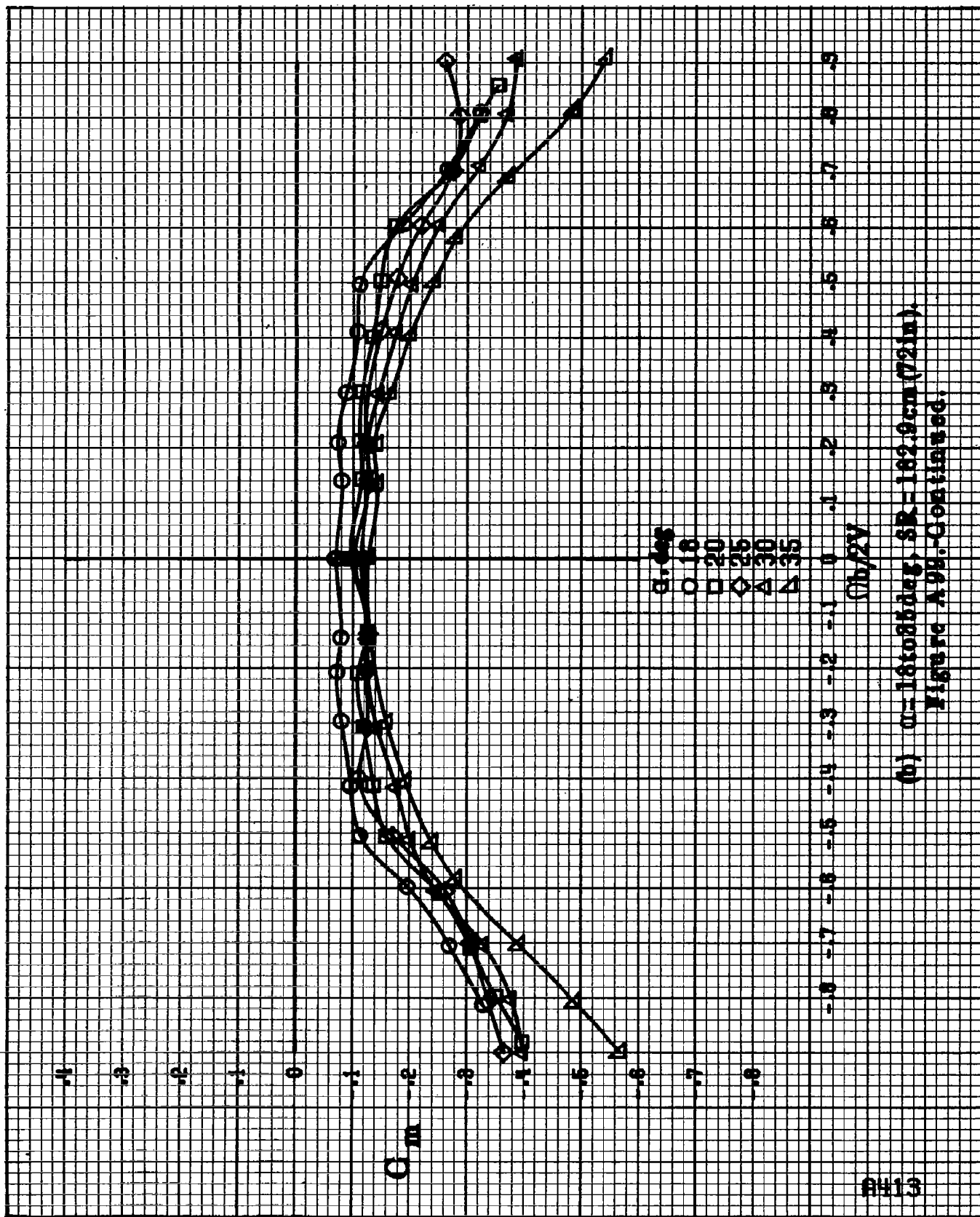


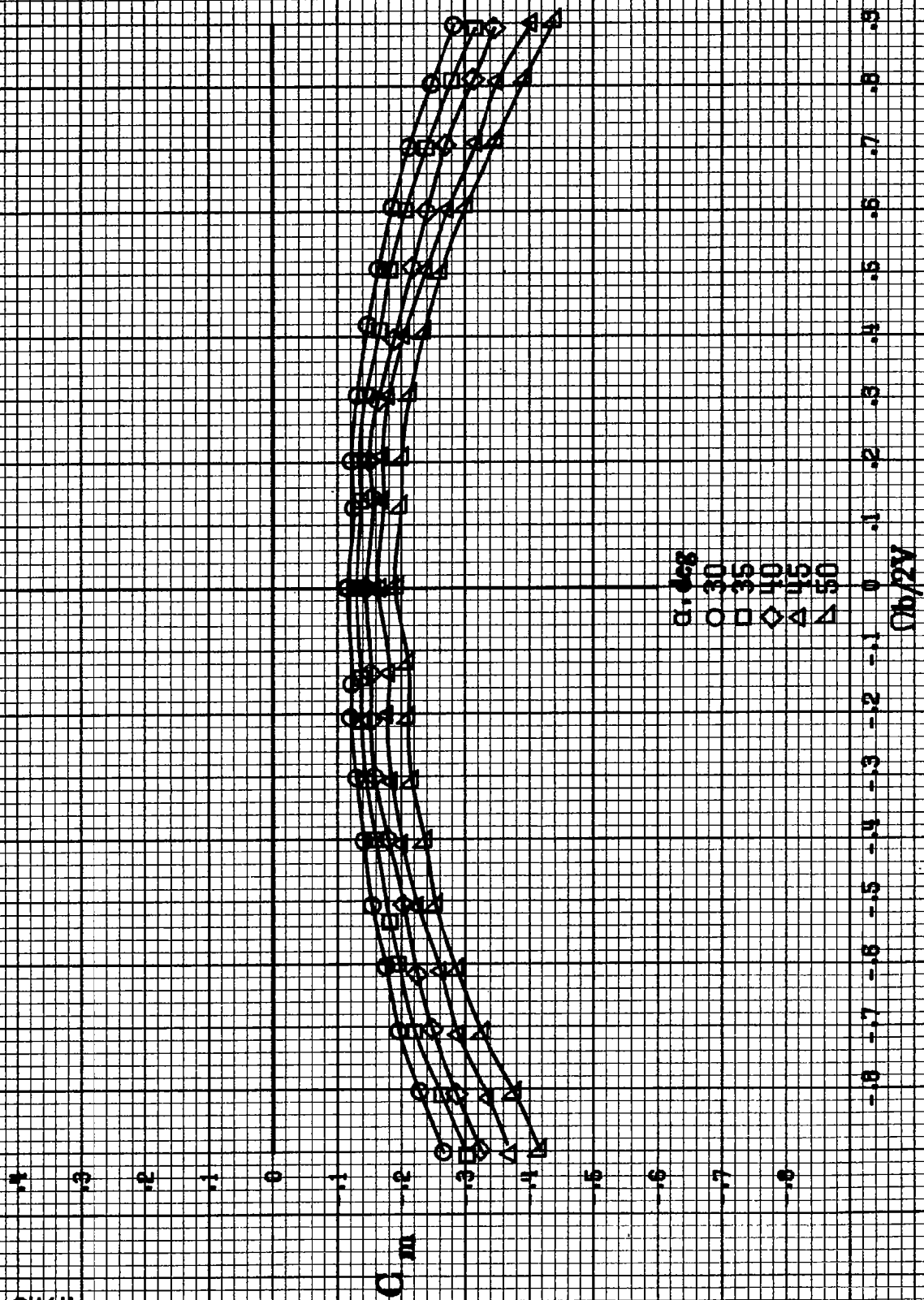
Figure A99. Effect of rotation rate and angle of attack on pitching-moment coefficient for horizontal and vertical tails off configuration.  $\delta_s = 0^\circ$ ,  $\delta_a = 0^\circ$ ,  $\beta = 0^\circ$ .  
(a)  $\alpha = 8^\circ, 10^\circ, 12^\circ, 14^\circ, 16^\circ$ ;  $SR = 1.92$  sem (72 in).



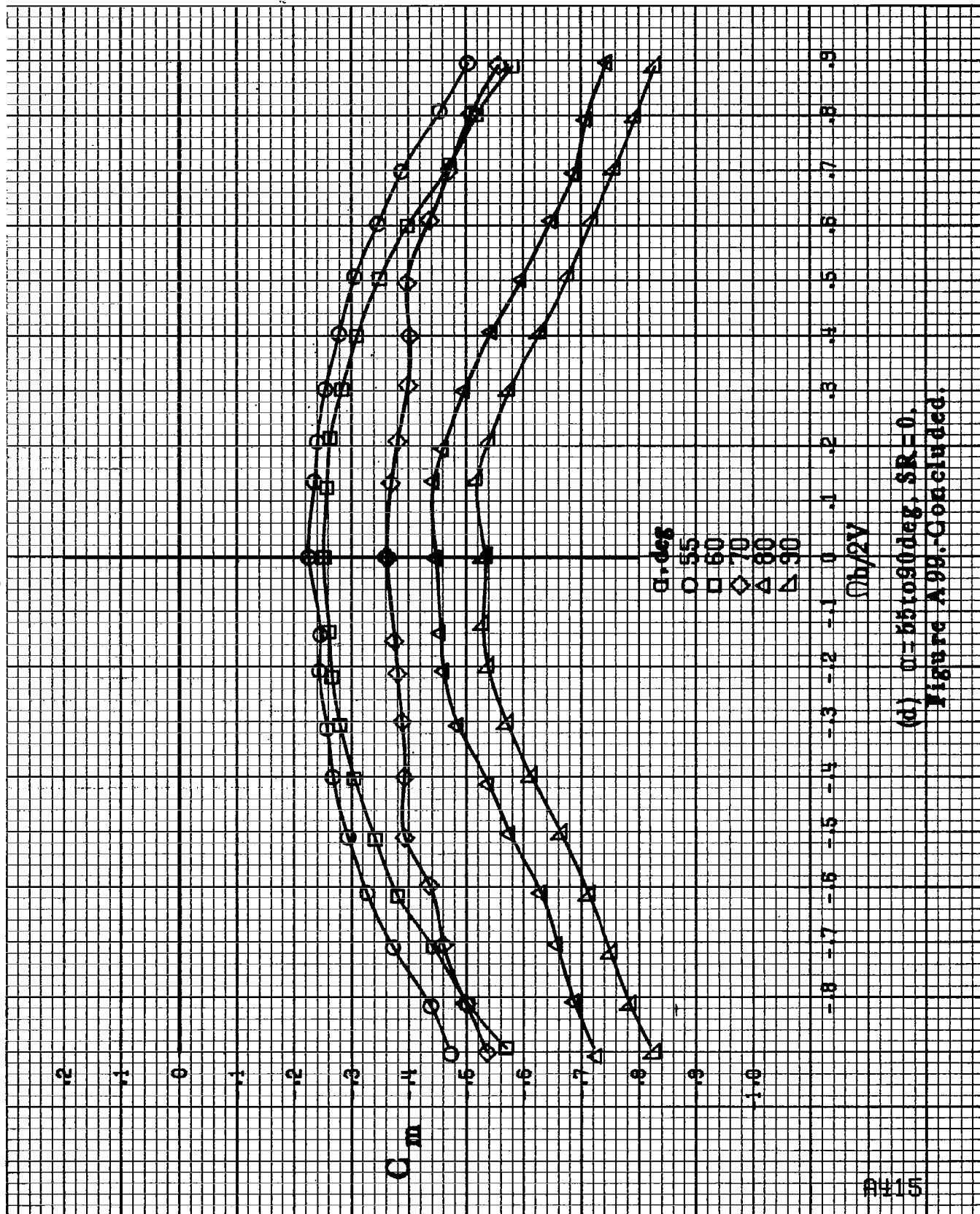


(b)  $\alpha = 18$  to  $45$  deg,  $SR = 182.9$  cm (72 in).  
Figure A.9. Continued.

PH14



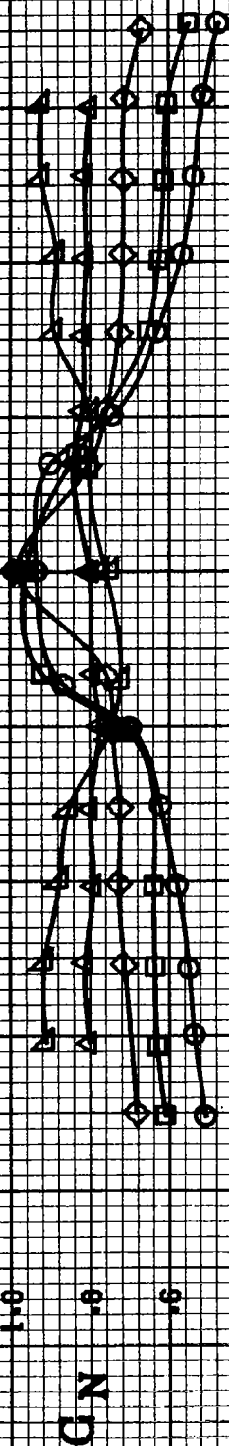
(c)  $\alpha=30$  to  $60$  deg,  $\beta R=0$ .  
Figure A99.-Continued.



(d)  $\alpha=55$  to  $90^\circ$ ,  $SR=0$ .  
Figure A9B.-Concluded.

BH16

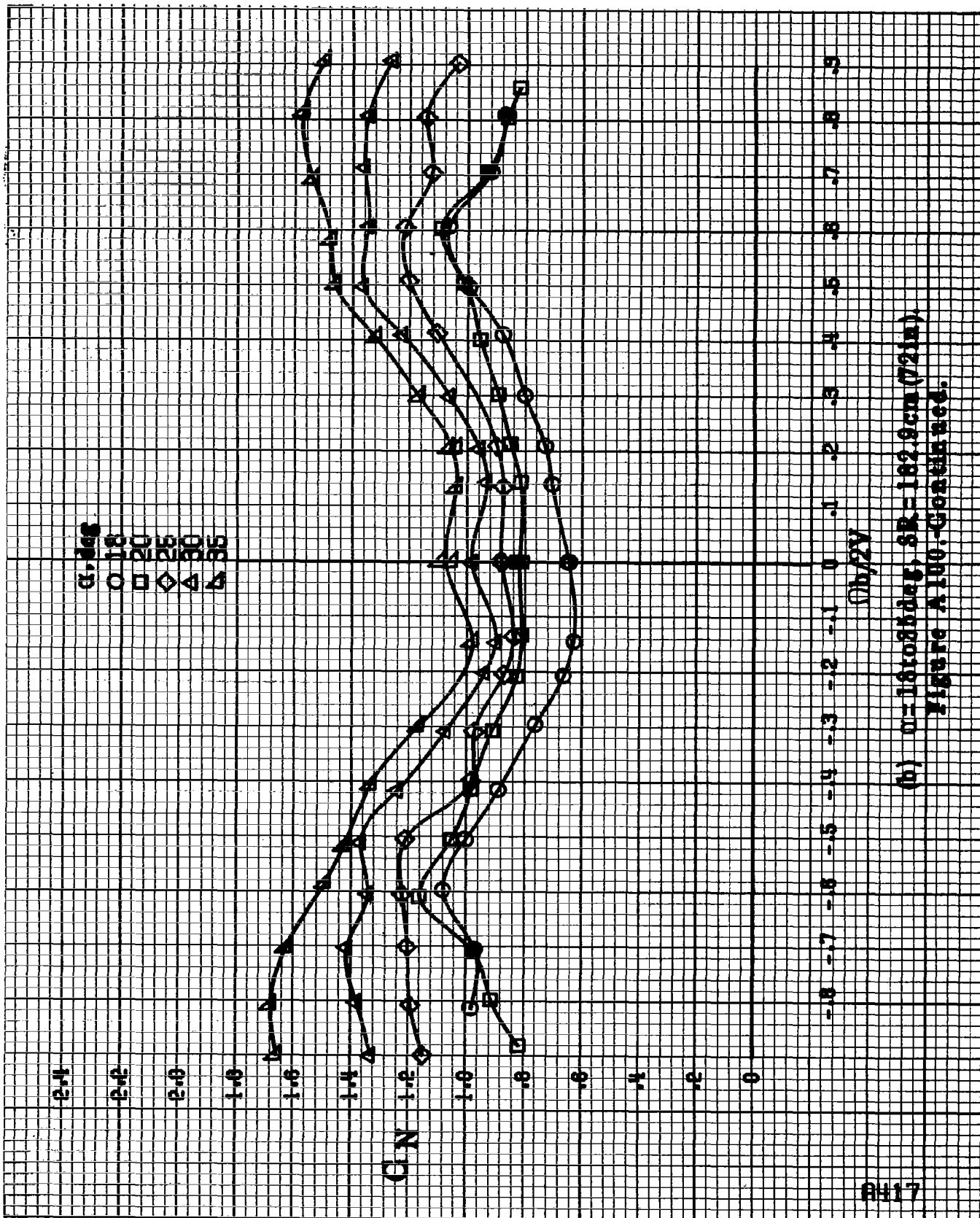
$\alpha, \text{deg}$   
 8  
 10  
 12  
 14  
 16



$C_L$

(a)  $\alpha = 84.16 \text{ deg}$ ,  $\delta_s = 182.9 \text{ cm } (7.2 \text{ in})$ .

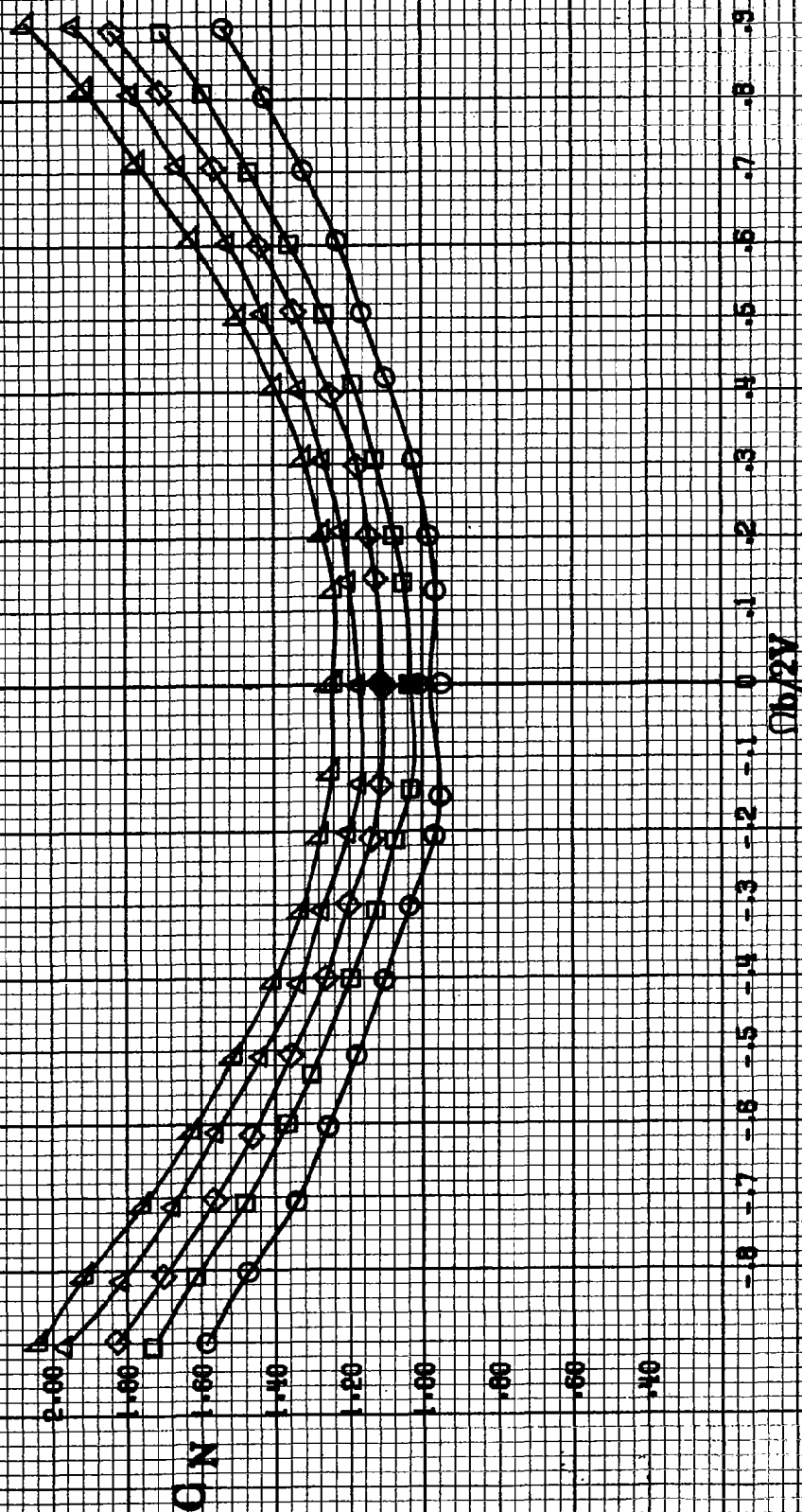
Figure A100.-Effect of rotation rate and angle of attack on normal-force coefficient for horizontal and vertical tails off configuration.  $\delta_s = 0^\circ$ ,  $\delta_a = 0^\circ$ ,  $\delta_s = 0^\circ$ ,  $\delta_a = 0^\circ$ .



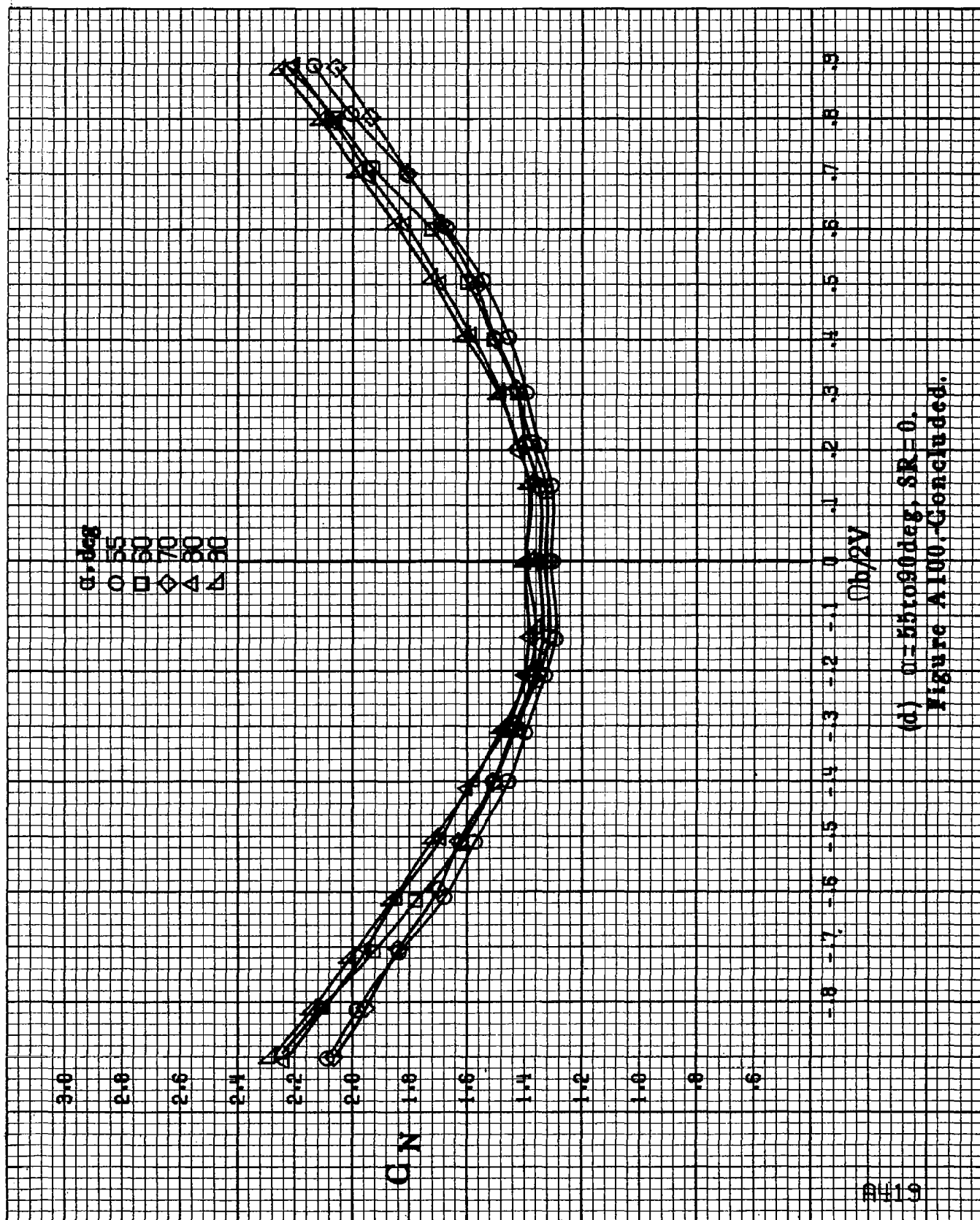
(b)  $n=1.81085$  deg,  $SR=182.9$  cm (72 in).  
Figure A100-Continued.

A418

$\alpha, \text{deg}$   
 ○ 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▽ 50



(c)  $\alpha = 30$  to  $60$  deg,  $\delta R = 0$ .  
 Figure A100-Continued.



(d)  $\alpha = 55$  to  $90$  deg,  $SR = 0$ .  
Figure A100.-Concluded.

0420

$\alpha, \text{ deg}$   
 8  
 10  
 12  
 14  
 16

$C_L$

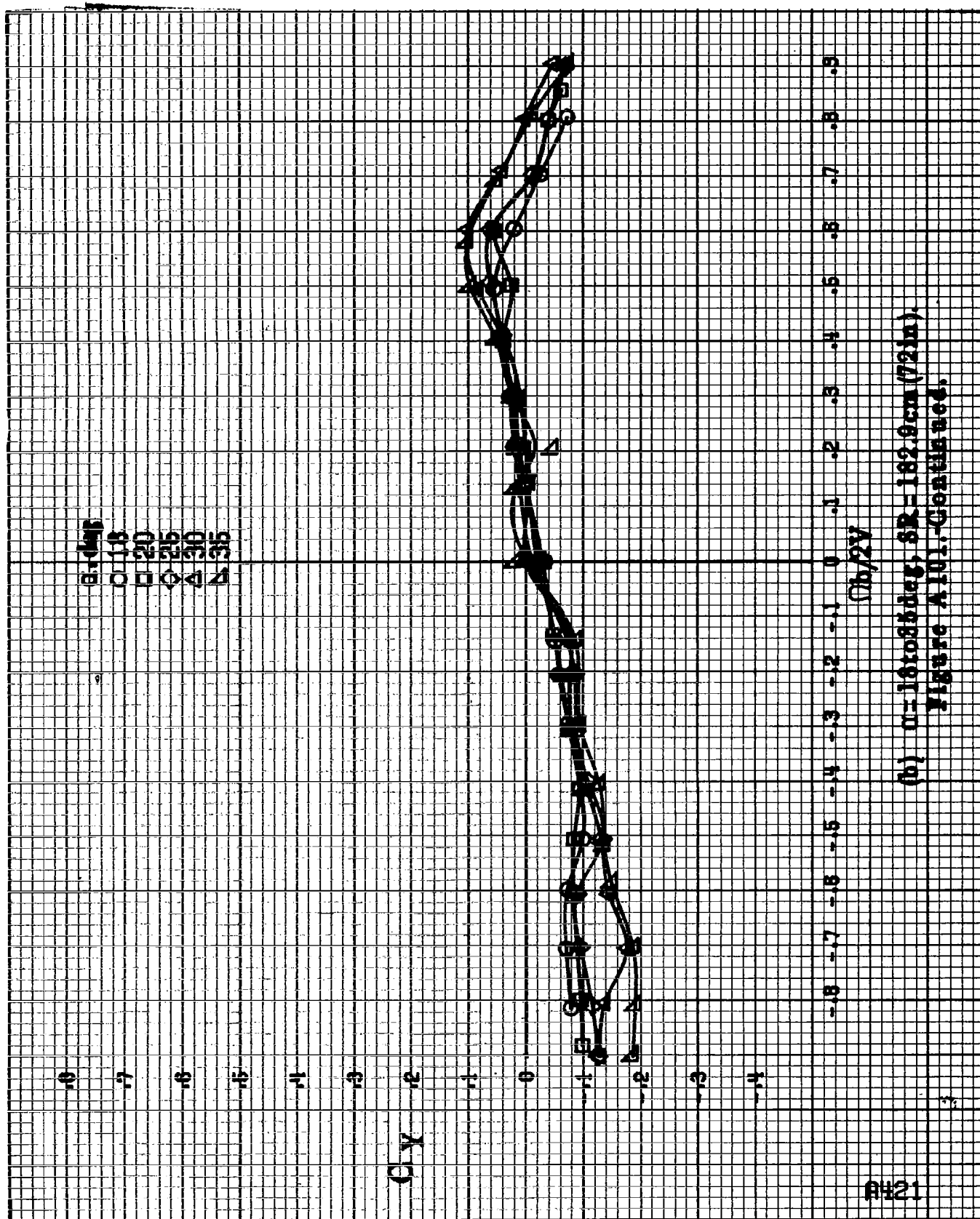
$M_0/90$

(a)  $\alpha = 84.18 \text{ deg}$ ,  $S_N = 192.9 \text{ cm}^2 (21 \text{ in}^2)$ .

Figure A101.-Effect of rotation rate and angle of attack on side-force coefficient for horizontal and vertical tails off configuration.  $\delta_a = 0^\circ$ ,  $\delta_e = 0^\circ$ .







(b)  $n=16$  to 88 deg,  $SR=182.9$  cm (72 in).  
Figure A101-Continued.

PH22

0

0.1

0.2

0.3

0.4

0.5

0.6

0.7

0.8

0.9

1.0

1.1

1.2

1.3

1.4

$\alpha, \text{deg}$

30

35

40

45

50

Gy

0

0.1

0.2

0.3

0.4

0.5

0.6

0.7

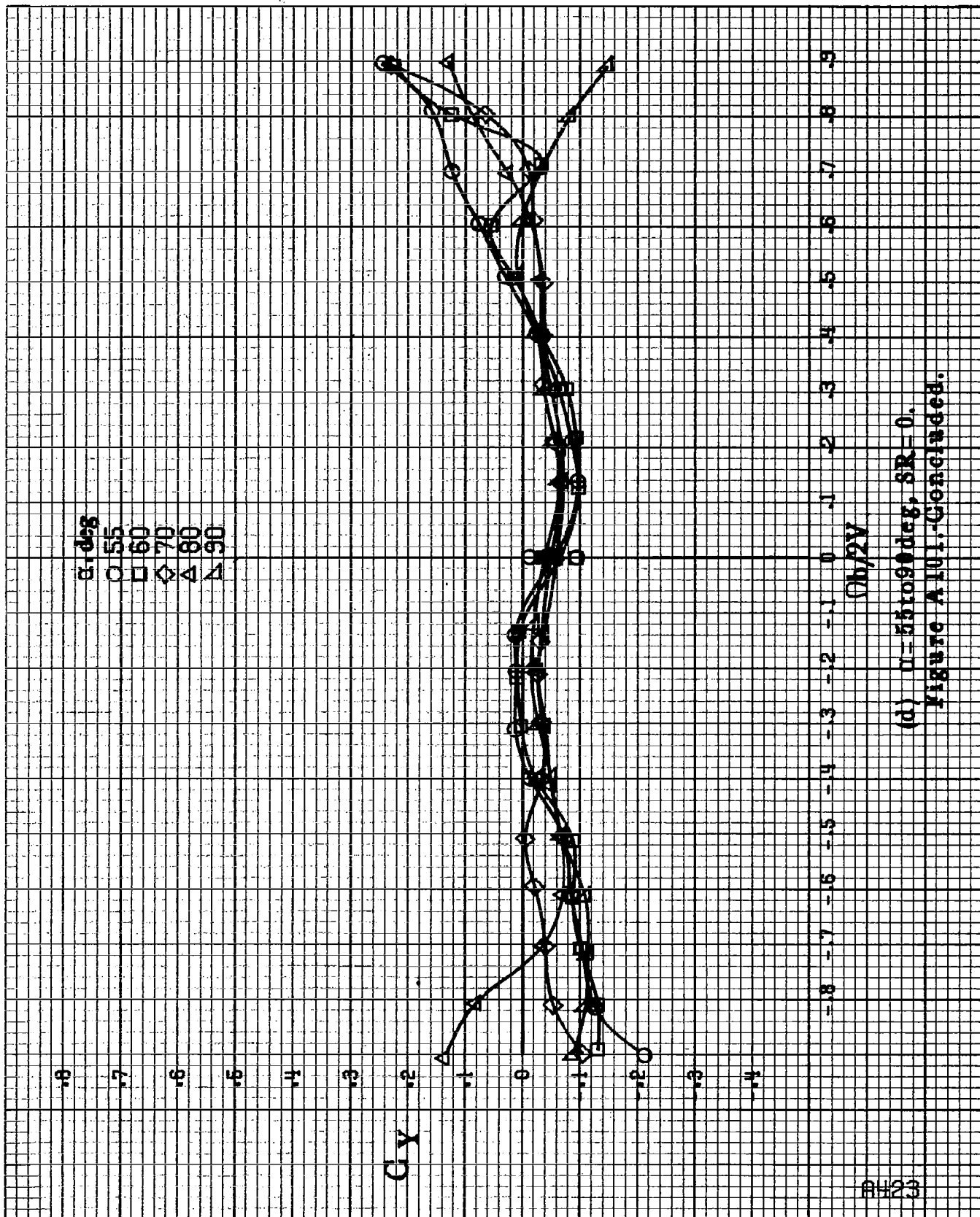
0.8

0.9

$\Omega_b/2\pi$

(c)  $\alpha = 80$  to  $50$  deg,  $\beta R = 0$ .

Figure A101-Continued.



(d)  $\alpha = 55$  to  $90$  deg,  $SR = 0$ .  
Figure A101-Concluded.

PH24

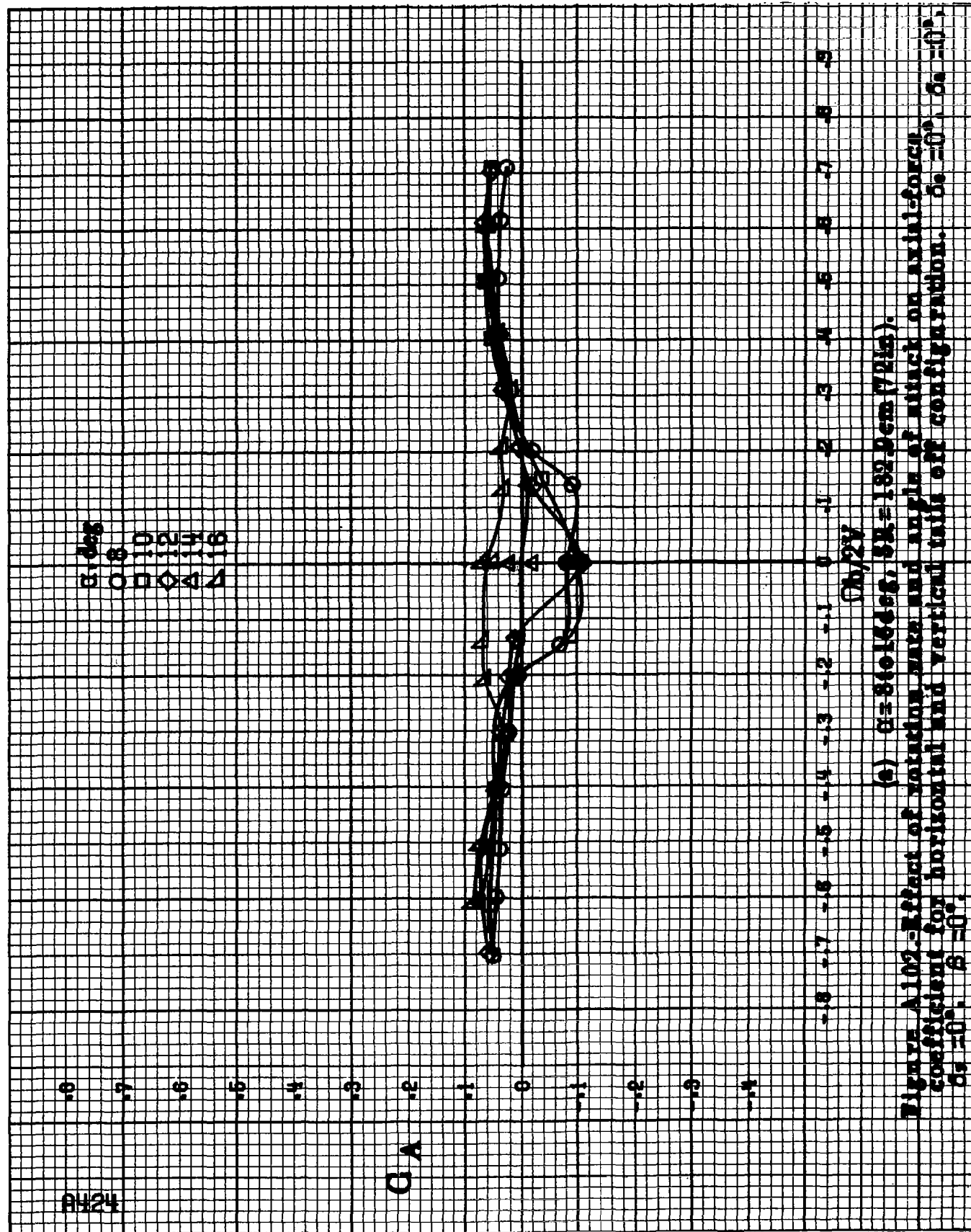
$\alpha, \text{deg}$   
 0 8  
 1 10  
 2 12  
 4 14  
 7 16

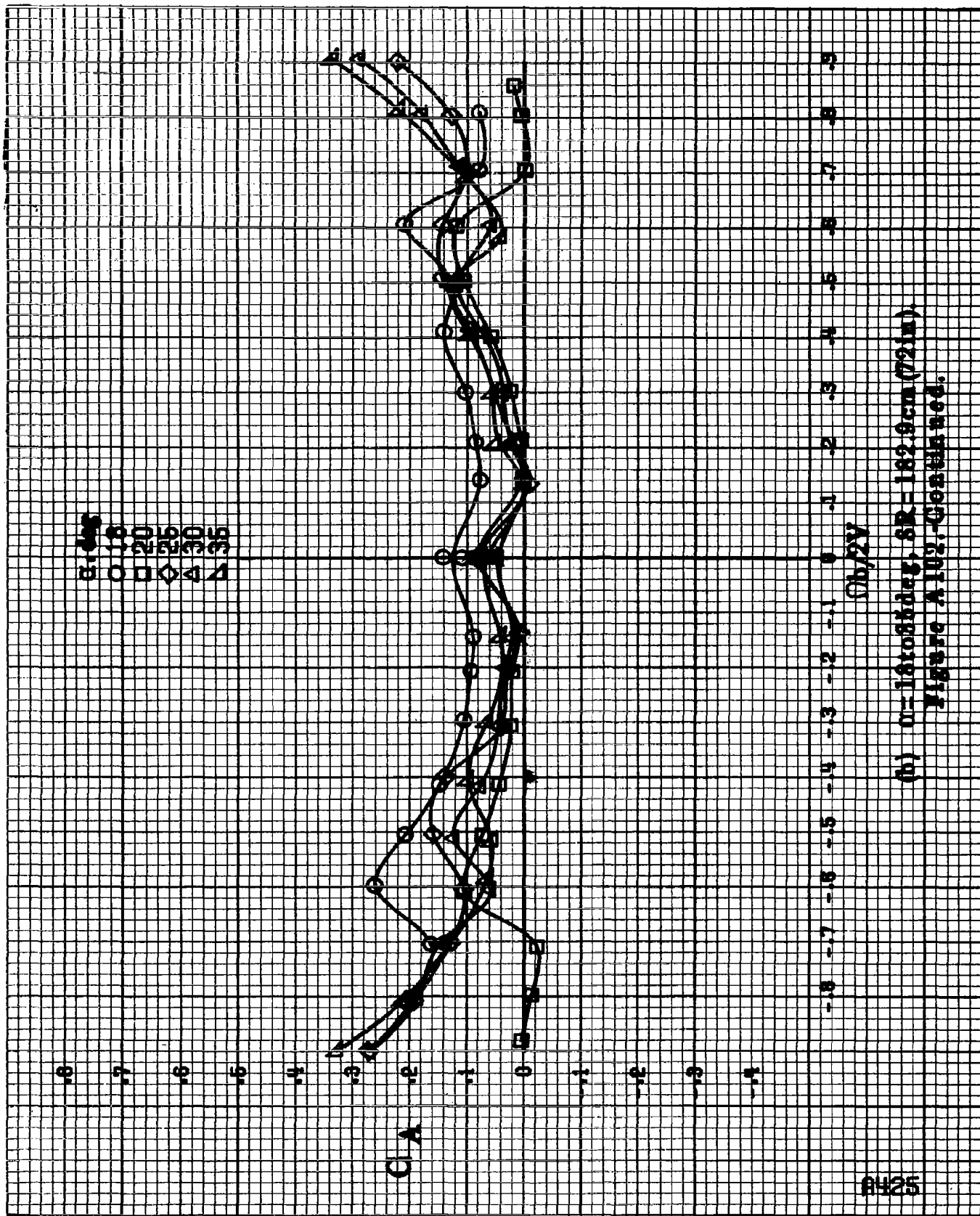
GA

$\Omega_b/2V$

(a)  $G=860164g$ ,  $SR=182.9\text{cm}(72\text{in})$ .

Figure A102.-Effect of rotation rate and angle of attack on axial-force coefficient for horizontal and vertical tails off configuration.  $\delta_a = 0^\circ$ ,  $\delta_v = 0^\circ$ ,  $\beta = 0^\circ$ .



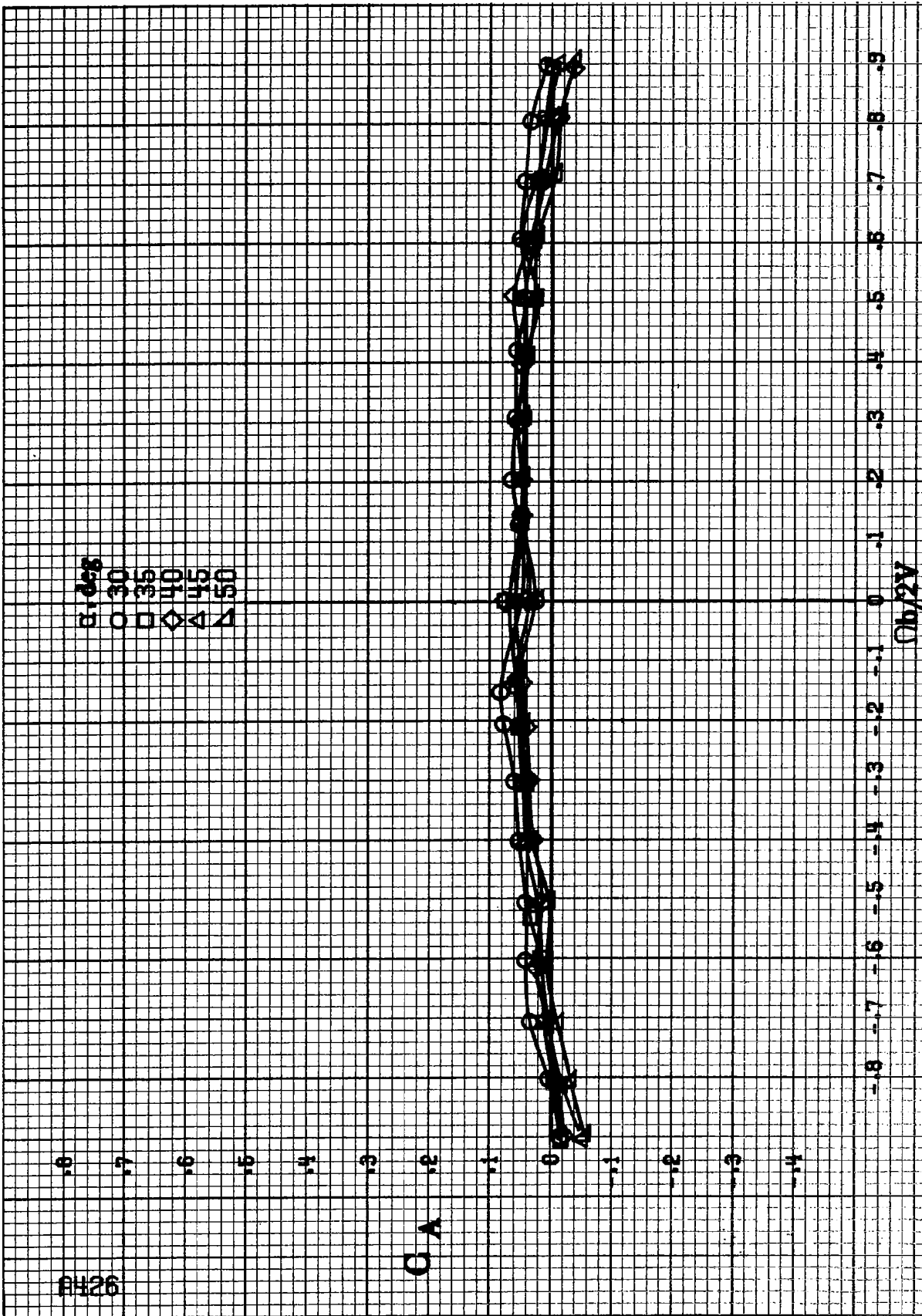


(b)  $\alpha = 16.08 \text{ kdeg}$ ,  $\delta R = 182.9 \text{ cm}$  ( $72 \text{ in}$ ).  
Figure A102-Continued.

8426

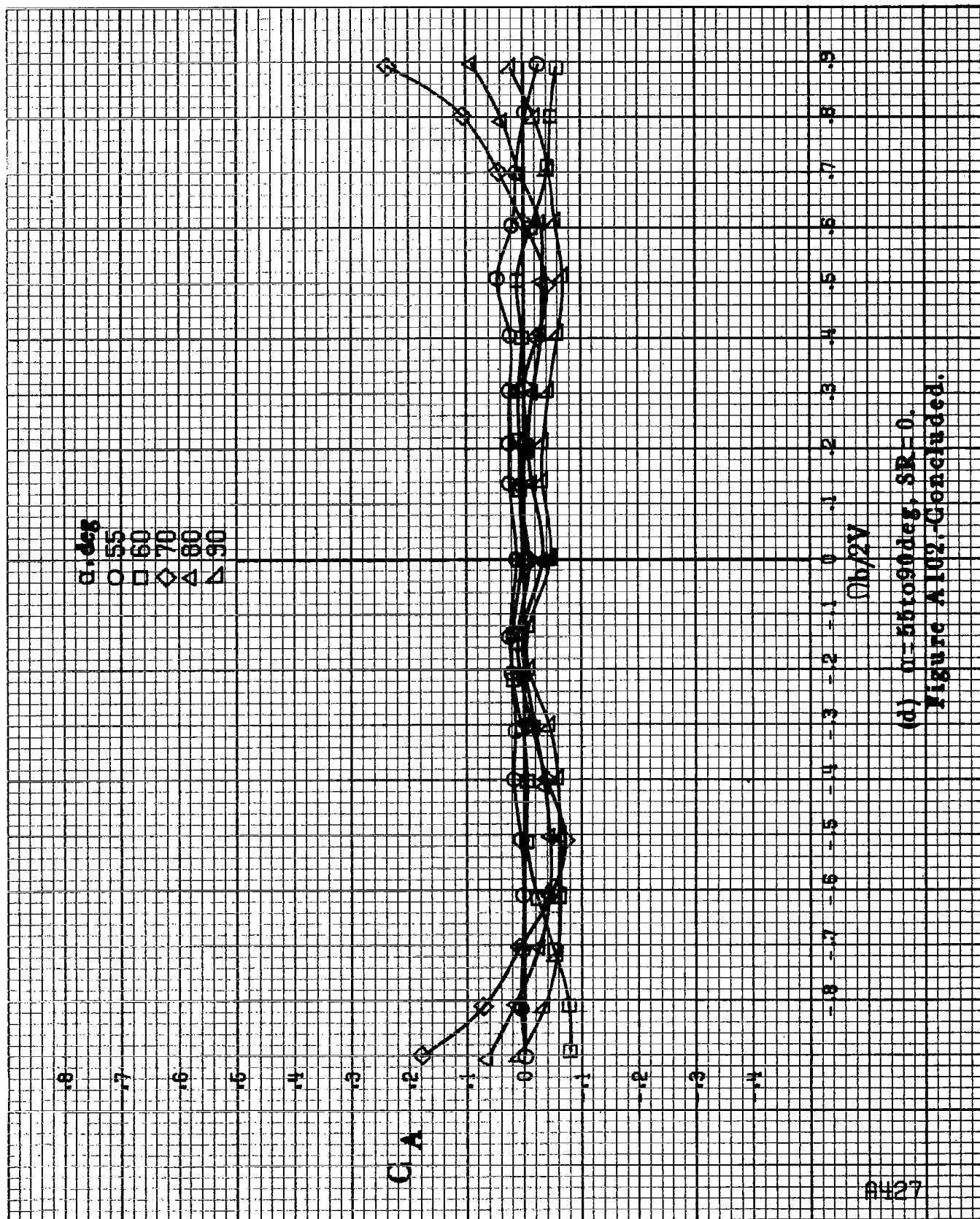
$\alpha, \text{deg}$   
 O 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▲ 50

C A



Ob/2V

(c)  $\alpha = 80$  to  $50$  deg,  $SR = 0$ .  
 Figure A102-Continued.



(d)  $\alpha = 55$  to  $90$  deg,  $SR = 0$ .  
Figure A102.-Continued.

8274

$\alpha$ , deg

○ 8  
□ 10  
◇ 12  
△ 14  
▽ 16

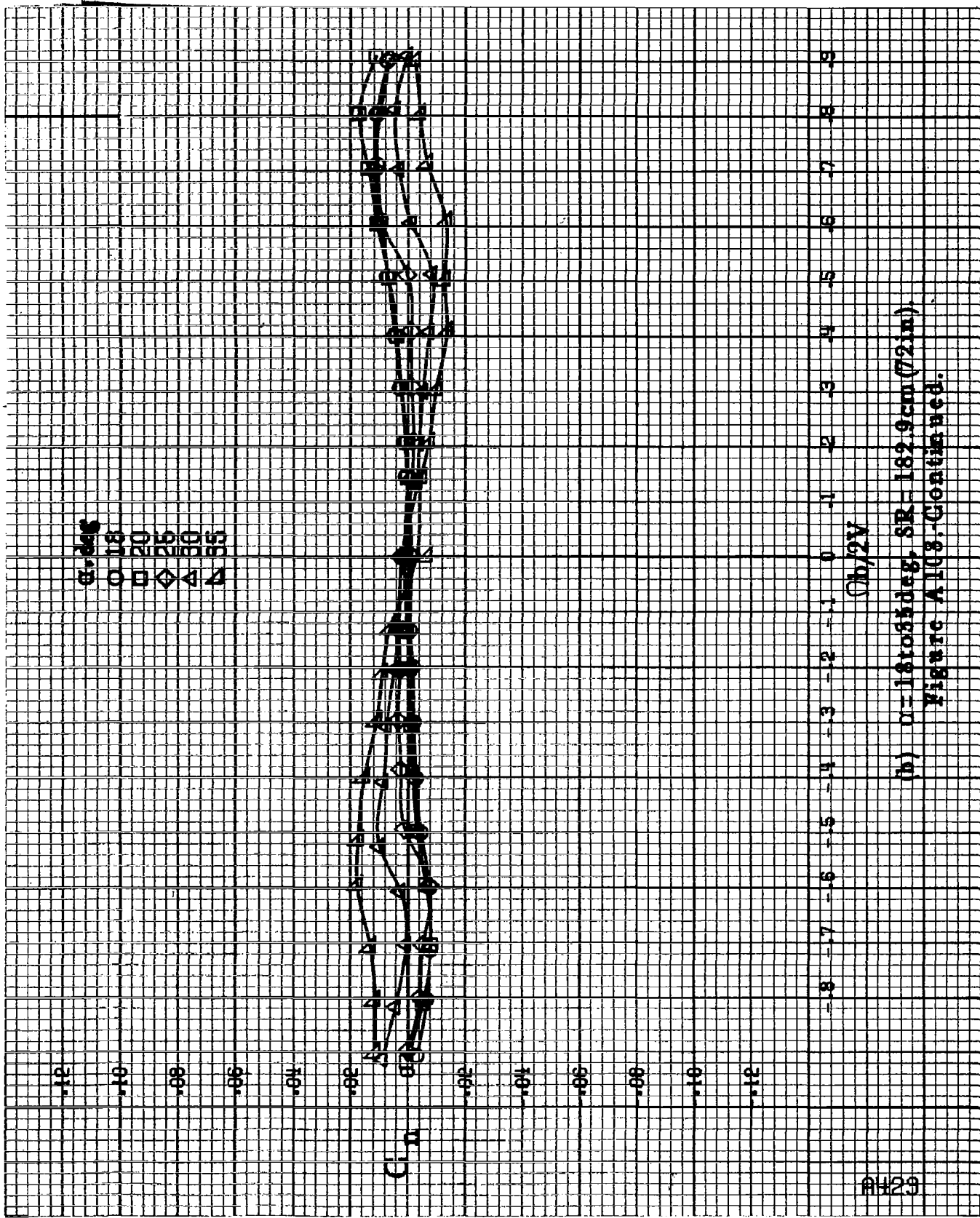
$C_n$

$\Omega b/2V$

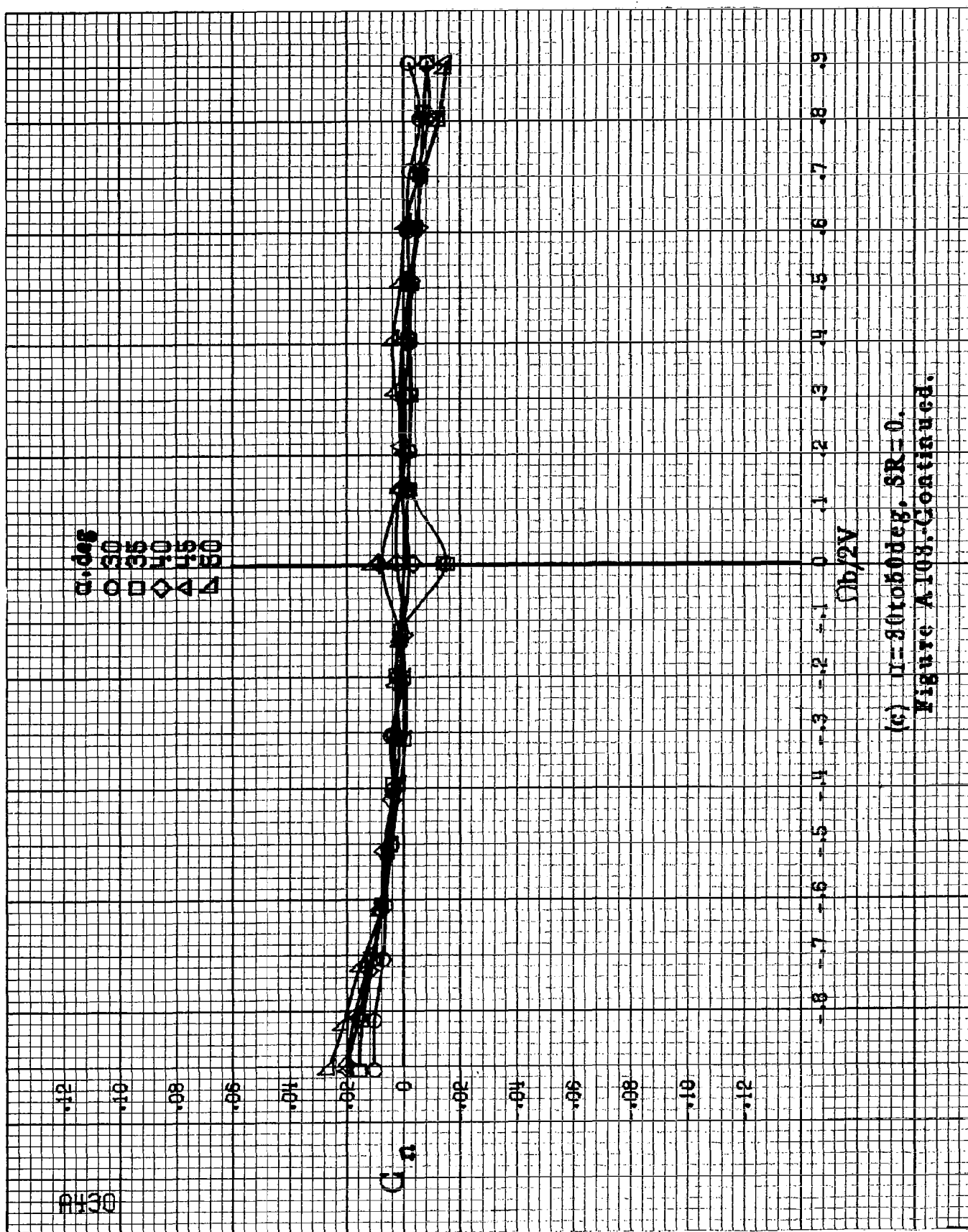
(a)  $\alpha = 8$  to  $16$  deg,  $SR = 132.9$  cm (72 in).

Figure A103.-Effect of rotation rate and angle of attack on yawing moment coefficient for body alone configuration.  $\delta_a = 0^\circ$ ,  $\delta_s = 0^\circ$ ,  $\delta = 0^\circ$ .



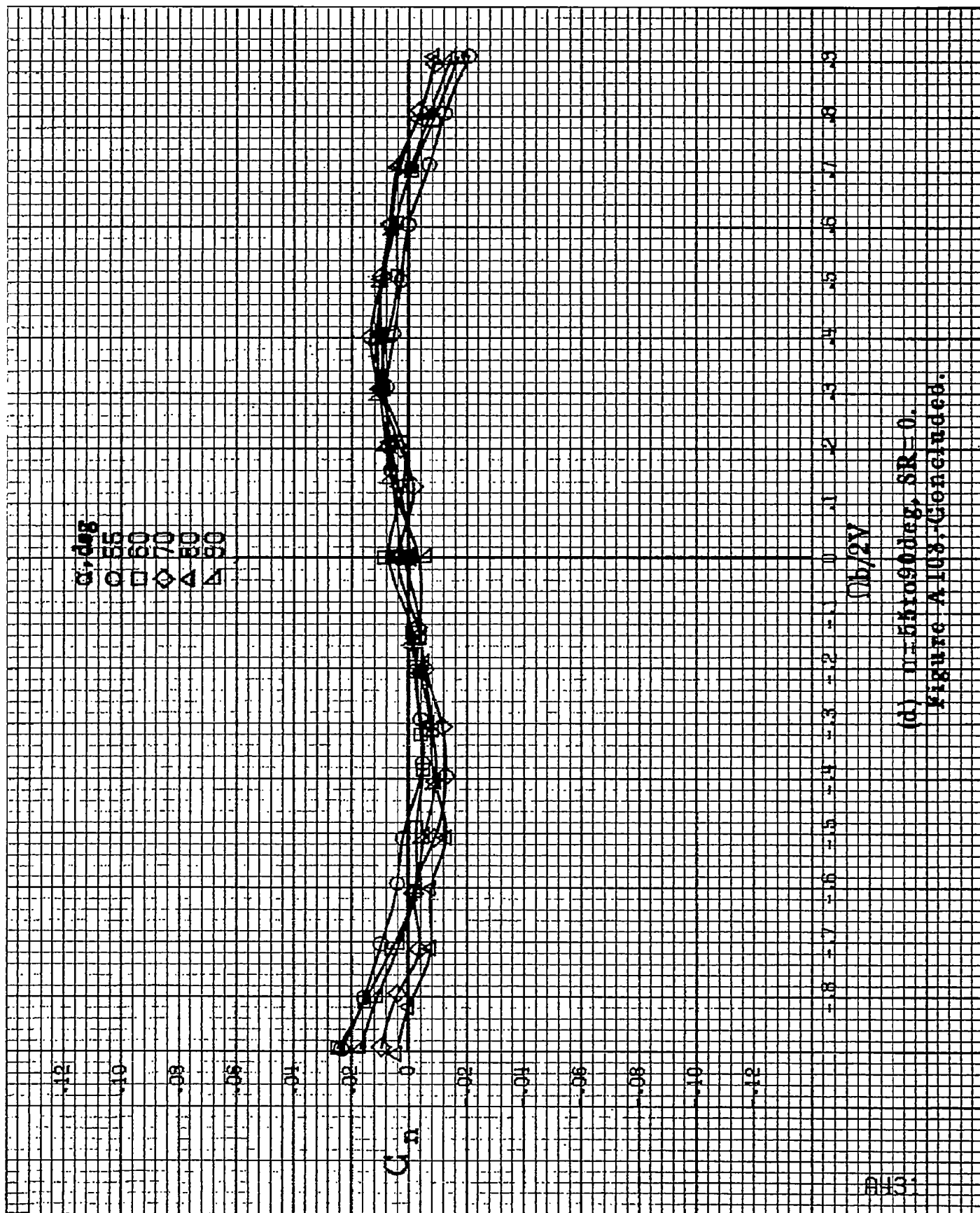


(b)  $\alpha = 18$  to  $55^\circ$ ,  $SR = 182.9 \text{ cm (72 in.)}$   
 Figure A103-Continued.



(c)  $\Gamma = 30$  to  $50$  deg,  $SR = 0$ .

Figure A103, Continued.



(d)  $\alpha = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A103-Continued.

$C_L$



$\alpha$ , deg

□ 8

□ 10

◇ 12

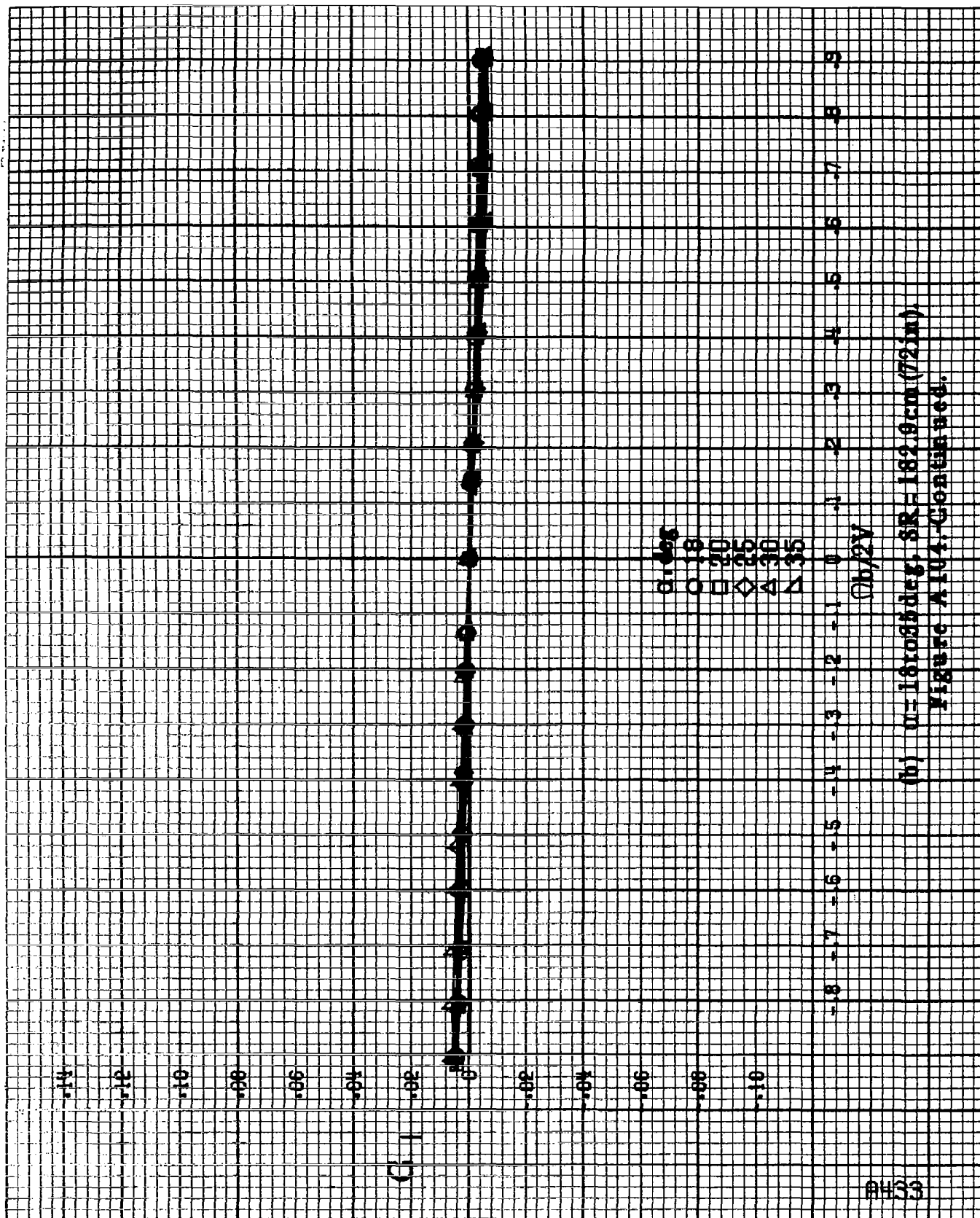
△ 14

▽ 16

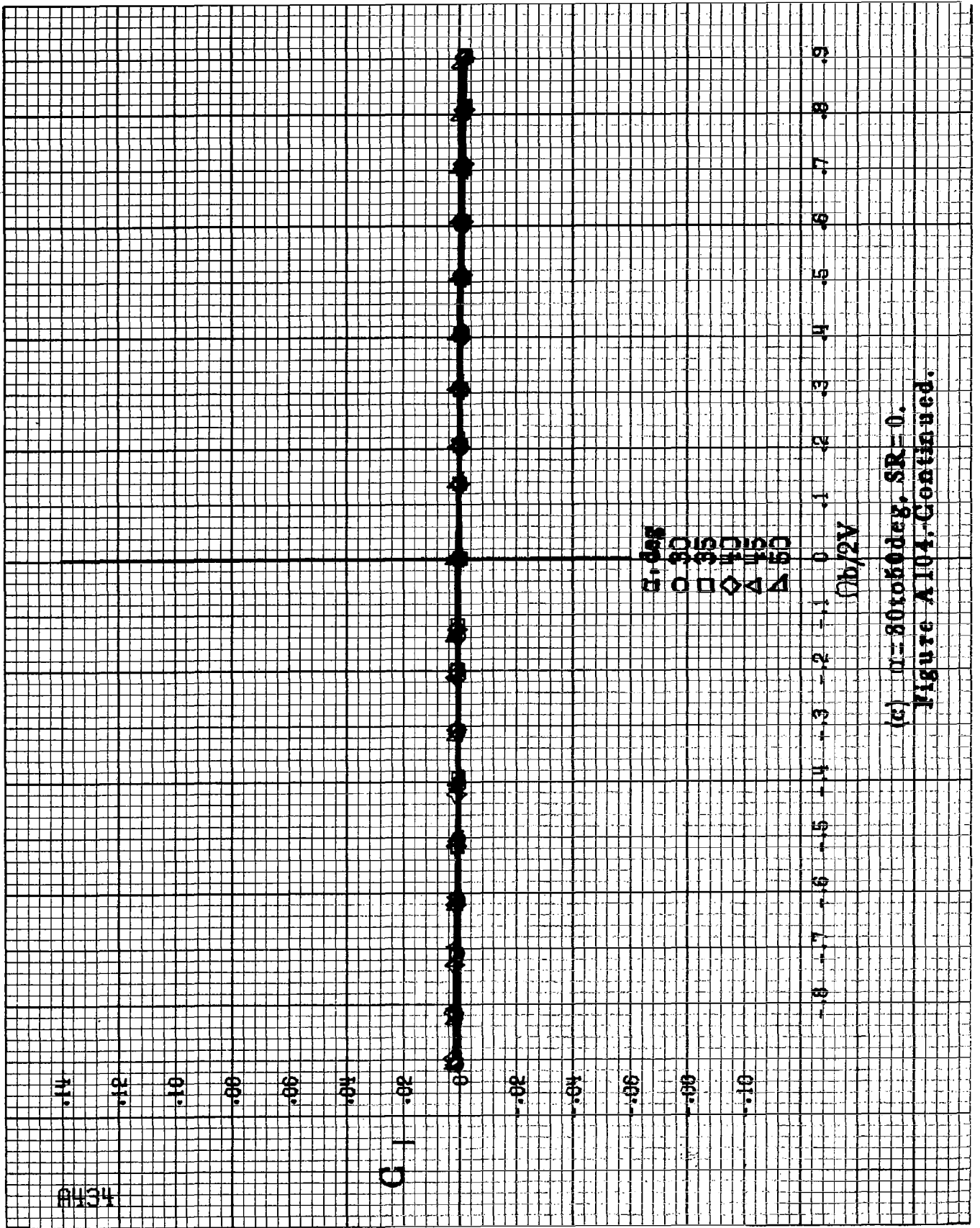
$\alpha_b/2V$

(a)  $\alpha = 8$  to  $16$  deg,  $SR = 182.9$  cm (72 in).

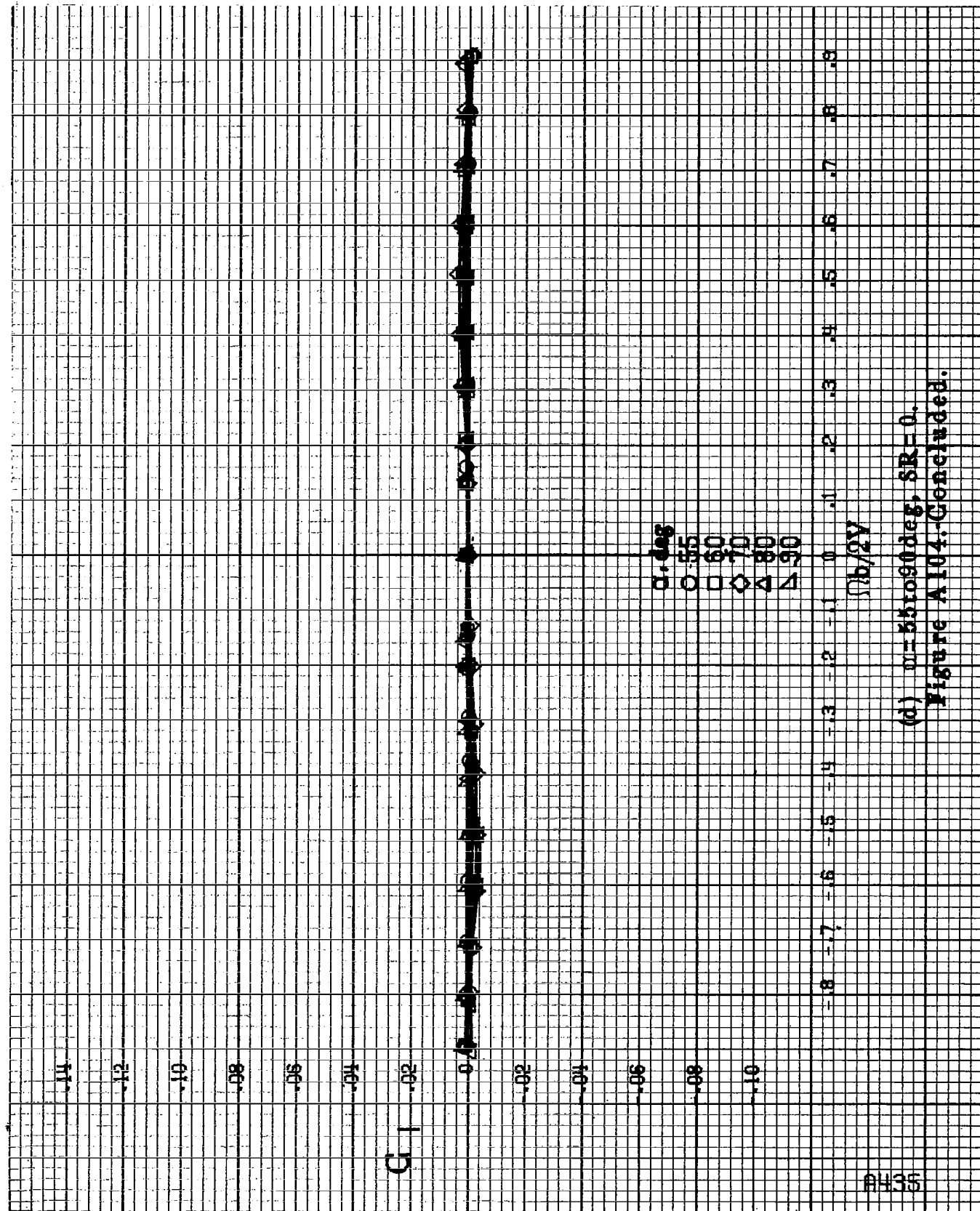
Figure A104.-Effect of rotation rate and angle of attack on rolling-moment coefficient for body alone configuration,  $\delta_a = 0^\circ$ ,  $\delta_r = 0^\circ$ ,  $\beta = 0^\circ$ .



(b)  $\mu=18.085$  deg,  $SR=182.9$  cm (72 in).  
Figure A104-Continued.



(c)  $\alpha = 30$  to  $60$  deg,  $SR = 0$ .  
Figure A104. Continued.



(d)  $\alpha = 55$  to  $90$  deg,  $SR = 0$ .  
Figure A104-Concluded.

$C_m$

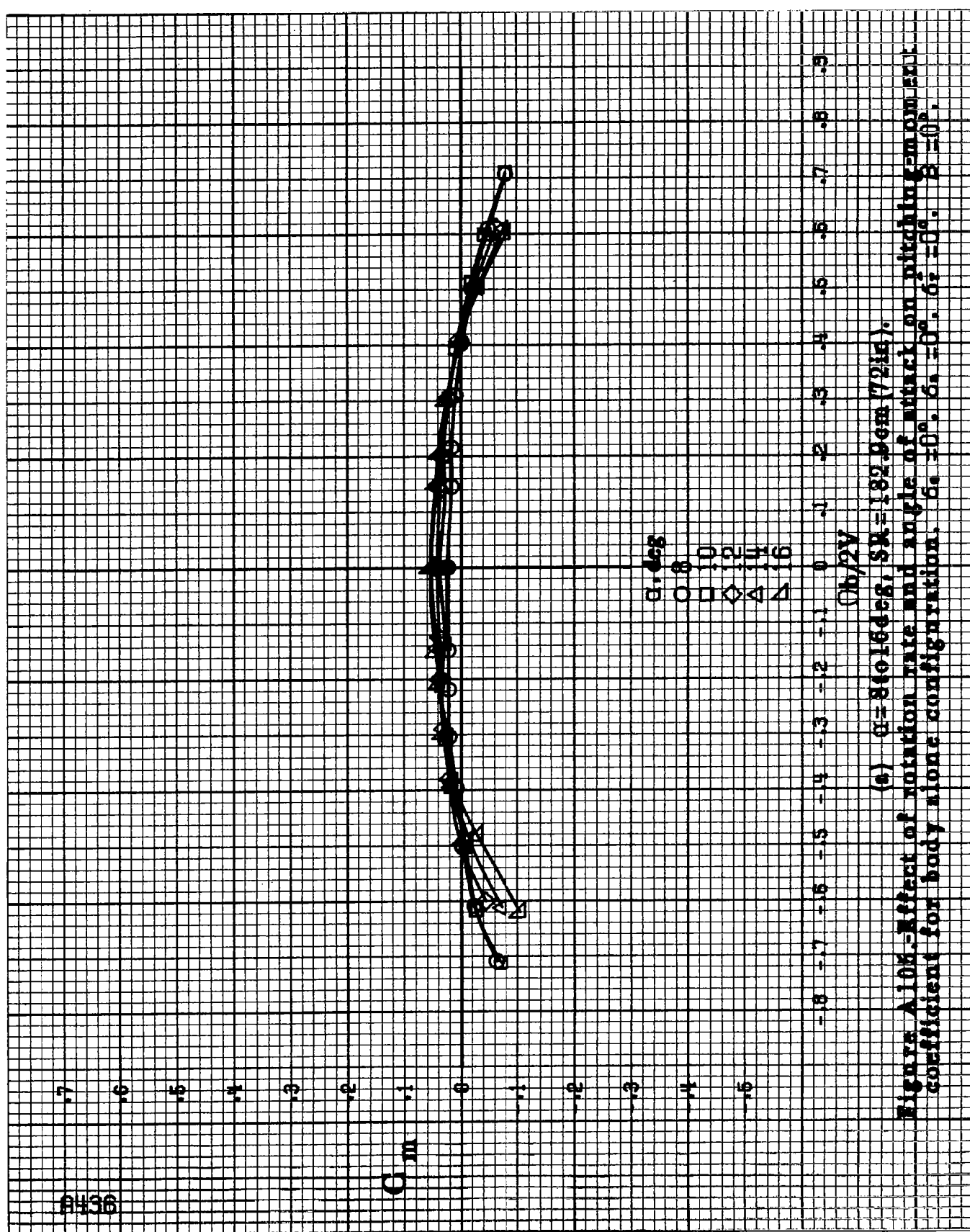
$\alpha, \text{deg}$

○ 8  
□ 10  
◇ 12  
△ 14  
▽ 16

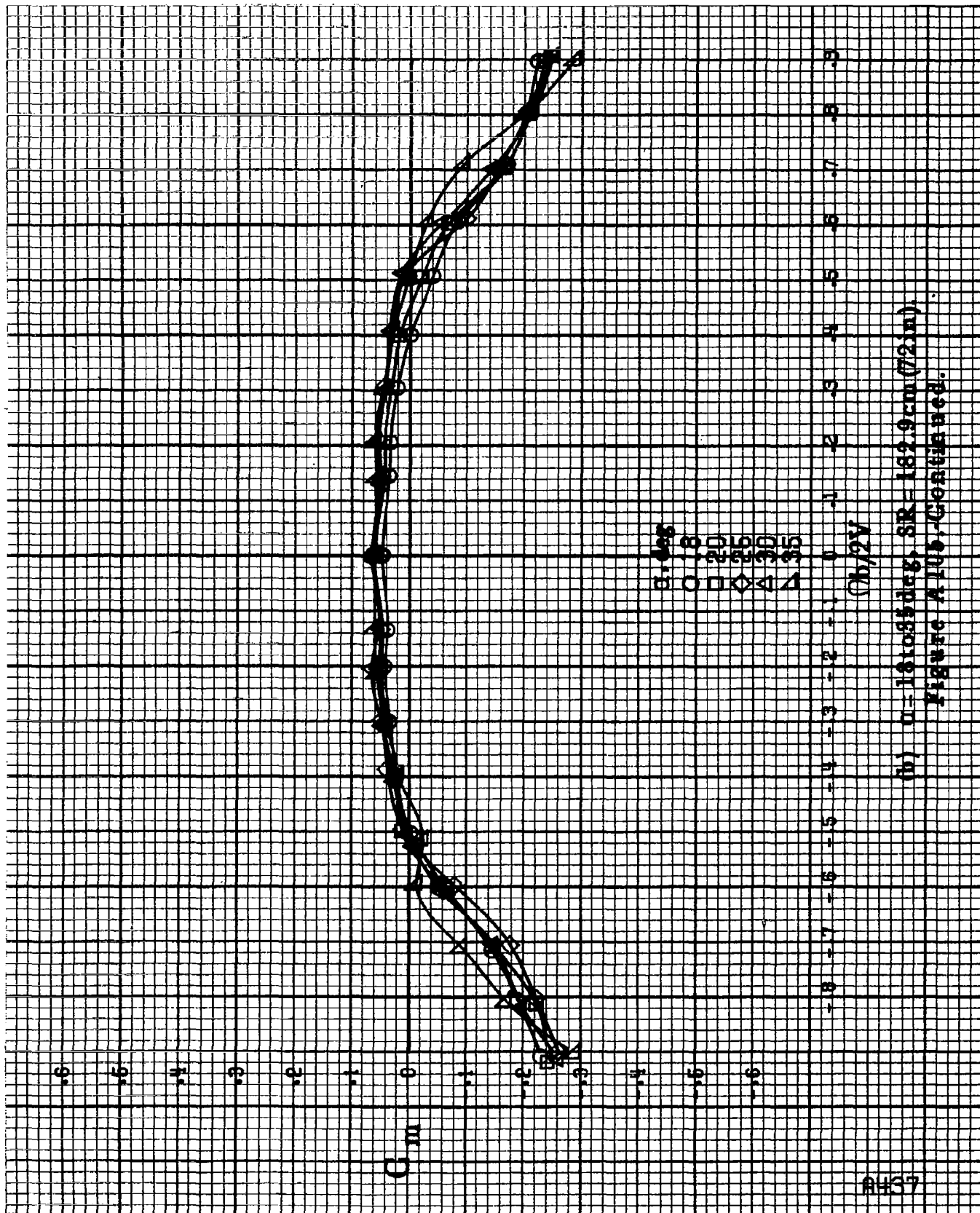
$Ob/2V$

(a)  $\alpha = 8$  to  $16 \text{ deg}$ ,  $SR = 182.9 \text{ cm} (72 \text{ in})$ .

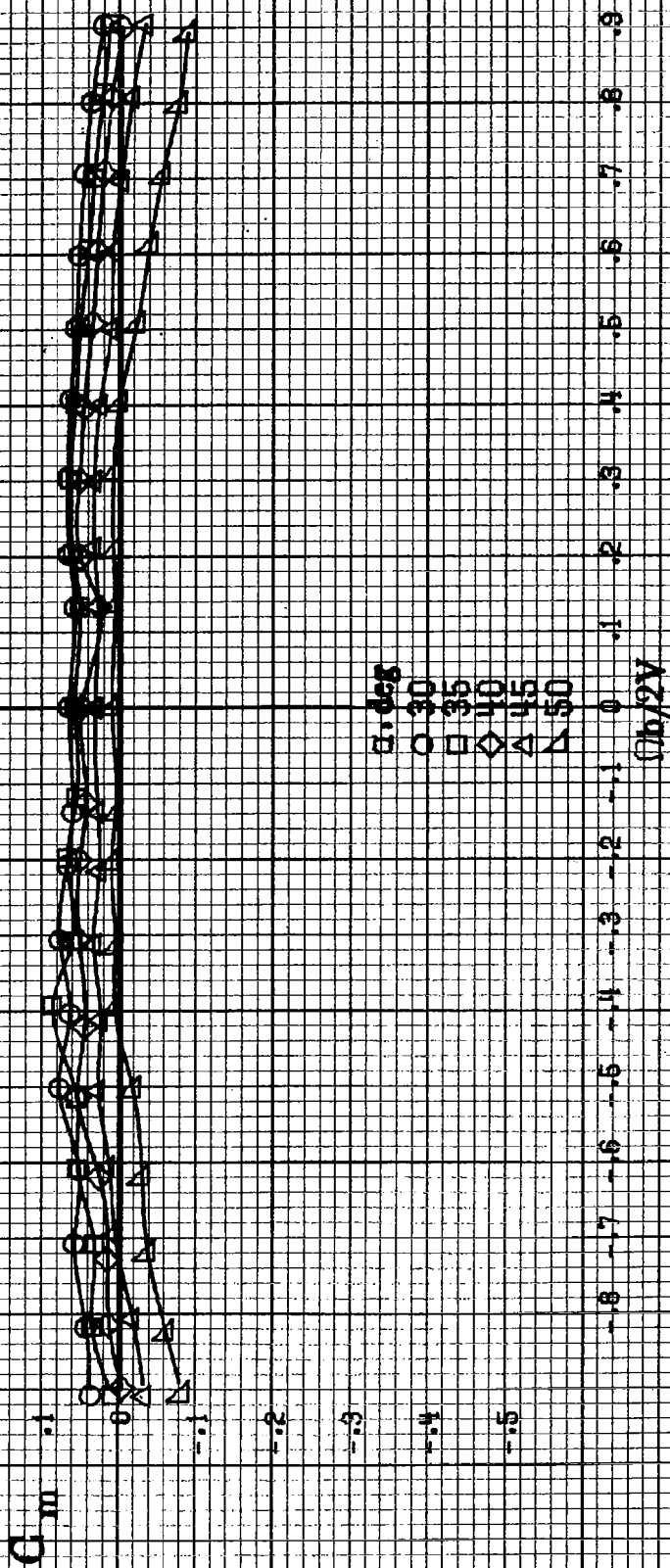
Figure A106.-Effect of rotation rate and angle of attack on pitching-moment coefficient for body alone configuration.  $\delta_a = 10^\circ$ ,  $\delta_s = 0^\circ$ ,  $\delta_r = 0^\circ$ ,  $\beta = 0^\circ$ .



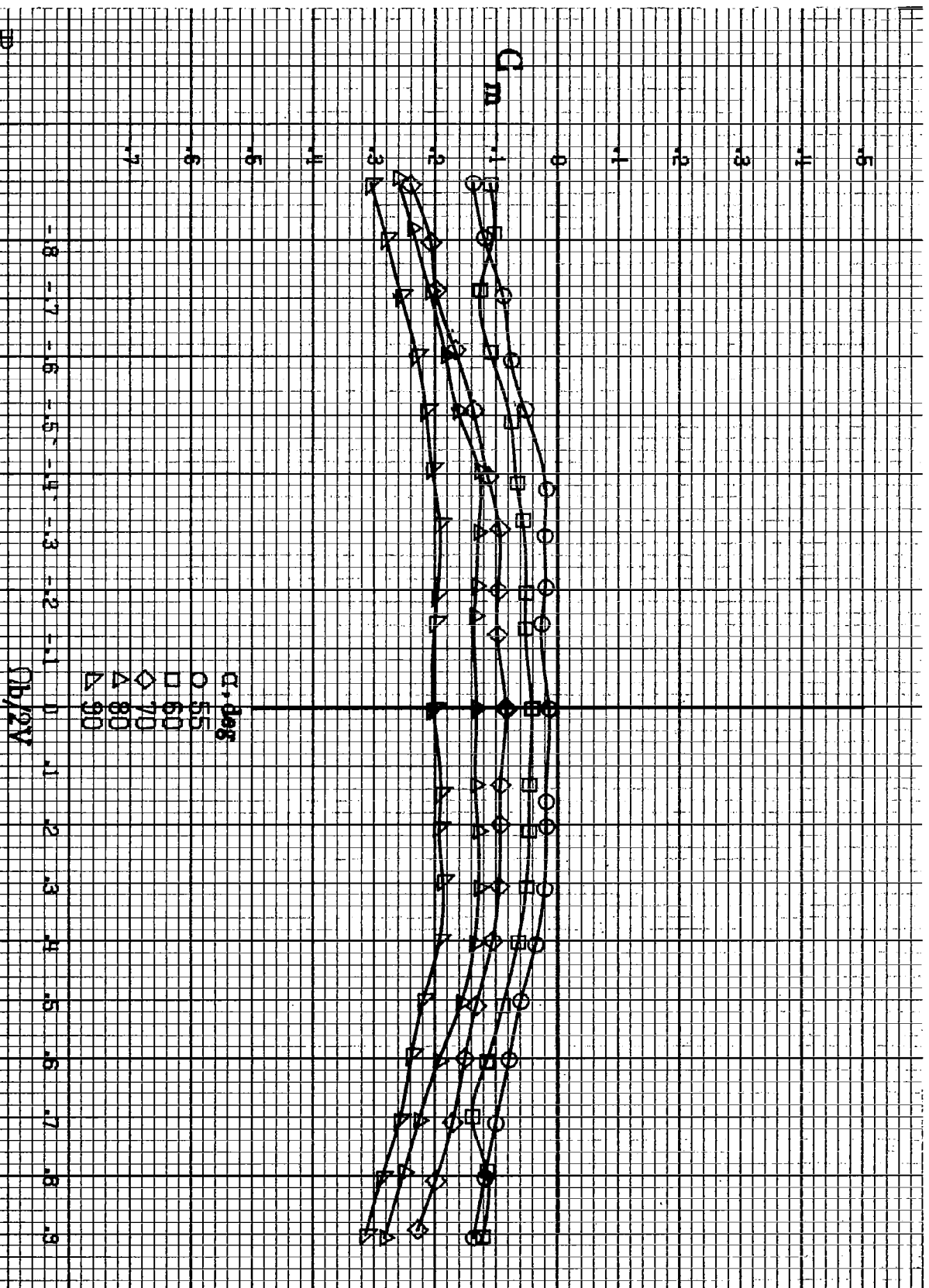




(b)  $\eta = 1.61085 \text{ deg}$ ,  $SR = 182.9 \text{ cm (72 in)}$ .  
 Figure A105-Continued.



(c)  $\alpha = 30$  to  $60$  deg,  $SR = 0$ .  
Figure A105-Continued.



(d)  $0=5510 \text{ deg}$ ,  $SR=0$ .  
Figure A105-Concluded.

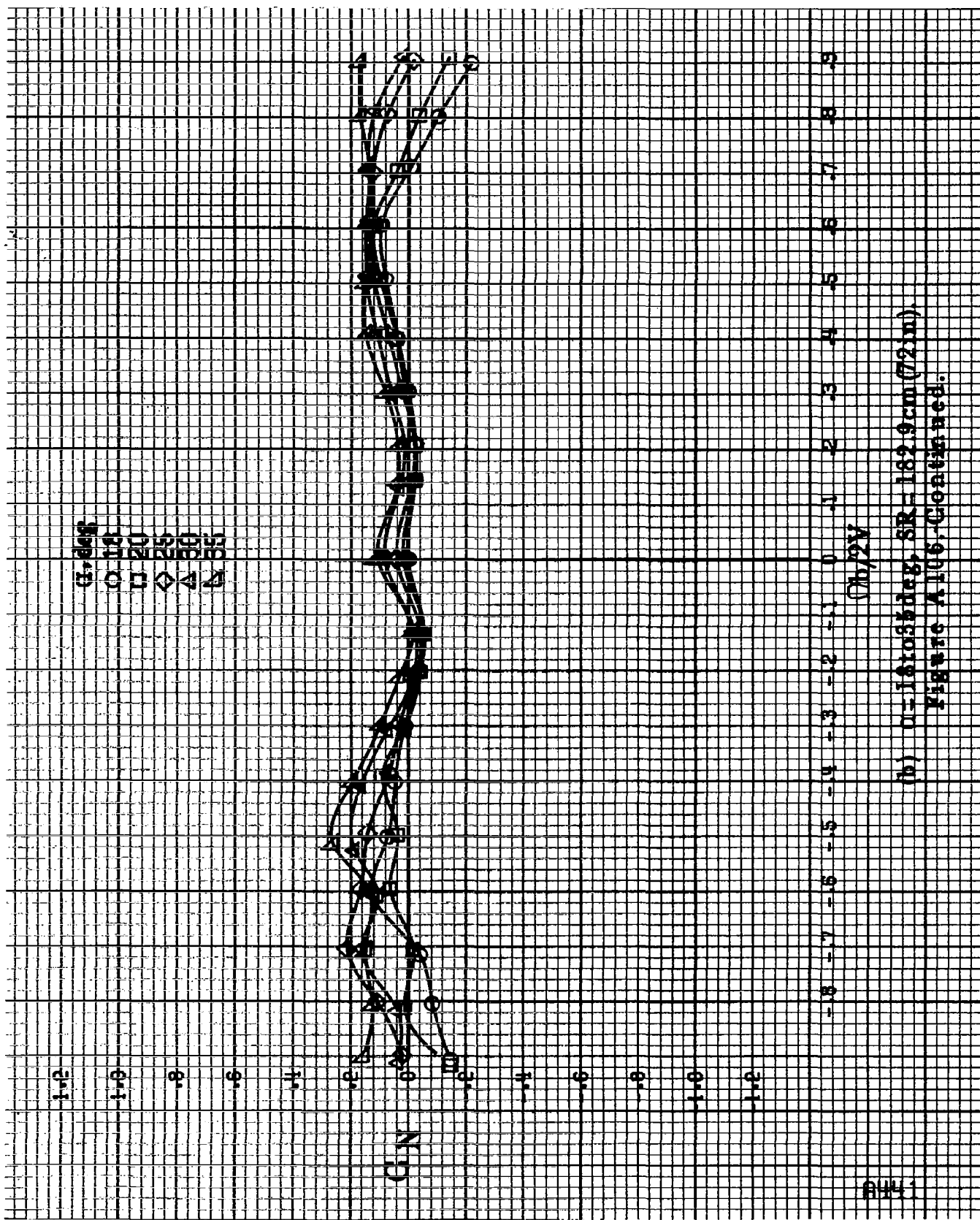
8440

$\alpha$ , deg  
 8  
 10  
 12  
 14  
 16

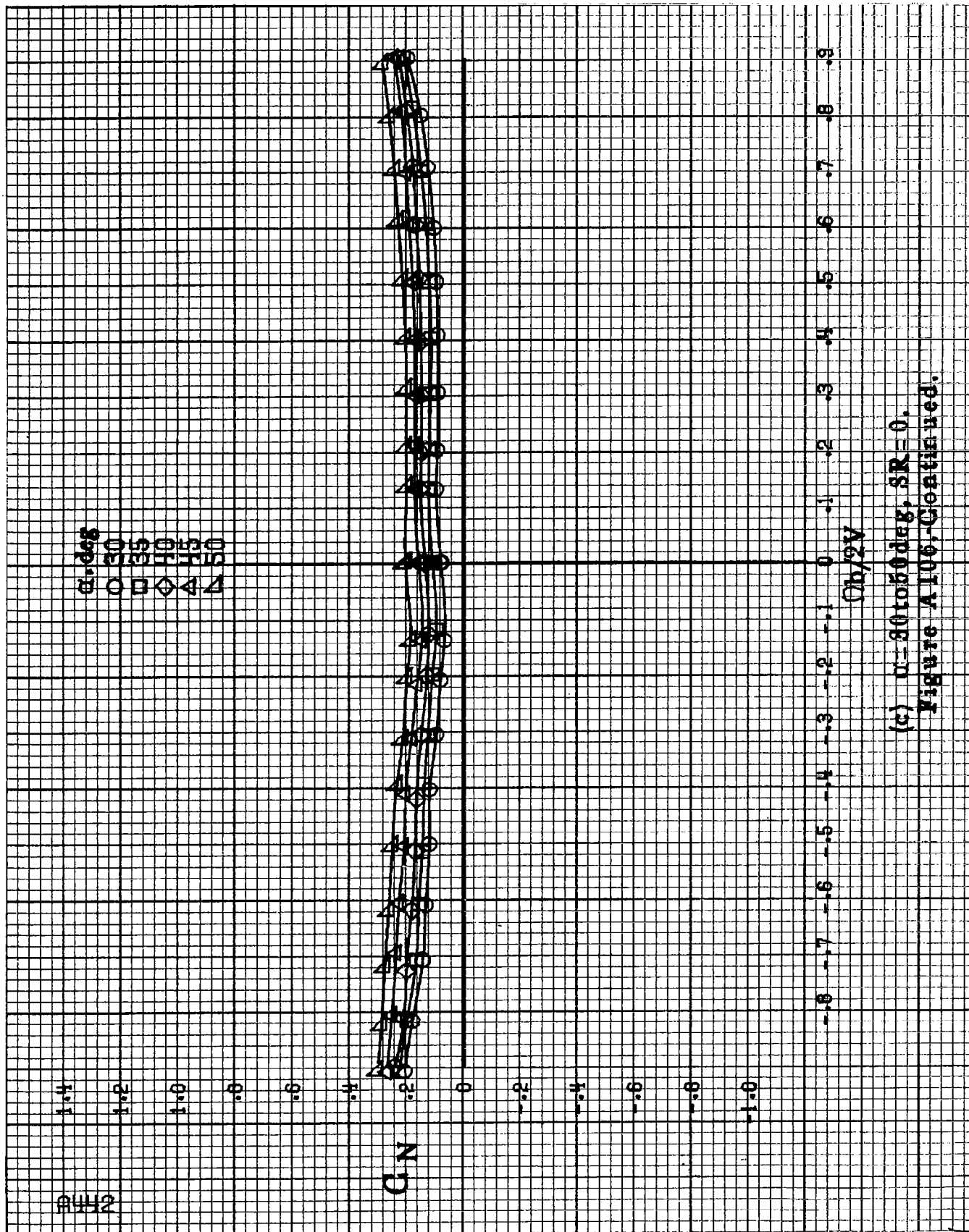
C/N

$C_N/2V$

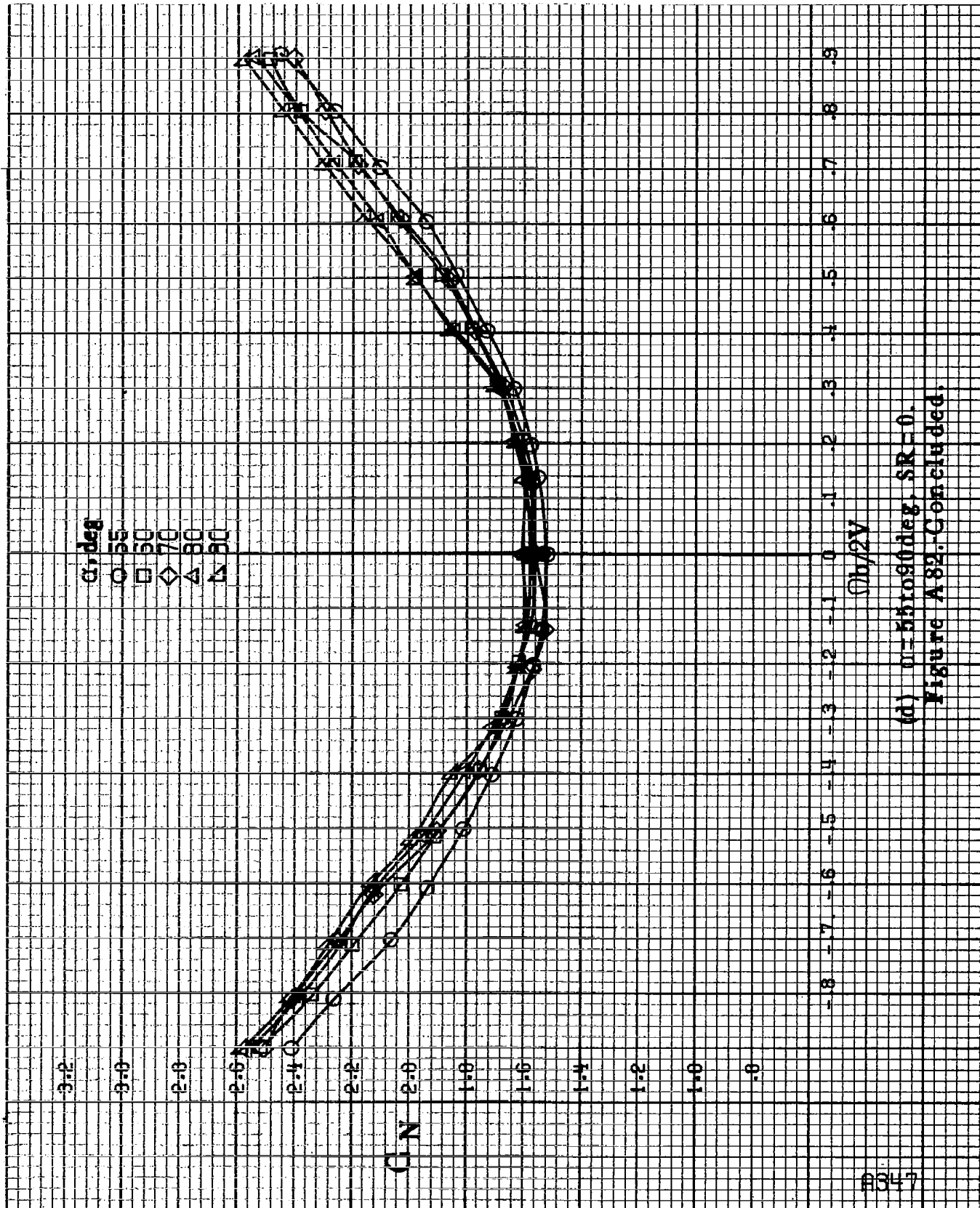
Figure A106.-Effect of rotation rate and angle of attack on normal-force coefficient for body alone configuration.  $\delta_a = 0^\circ$ .  $\delta_a = 0^\circ$ .  $\delta_a = 0^\circ$ .



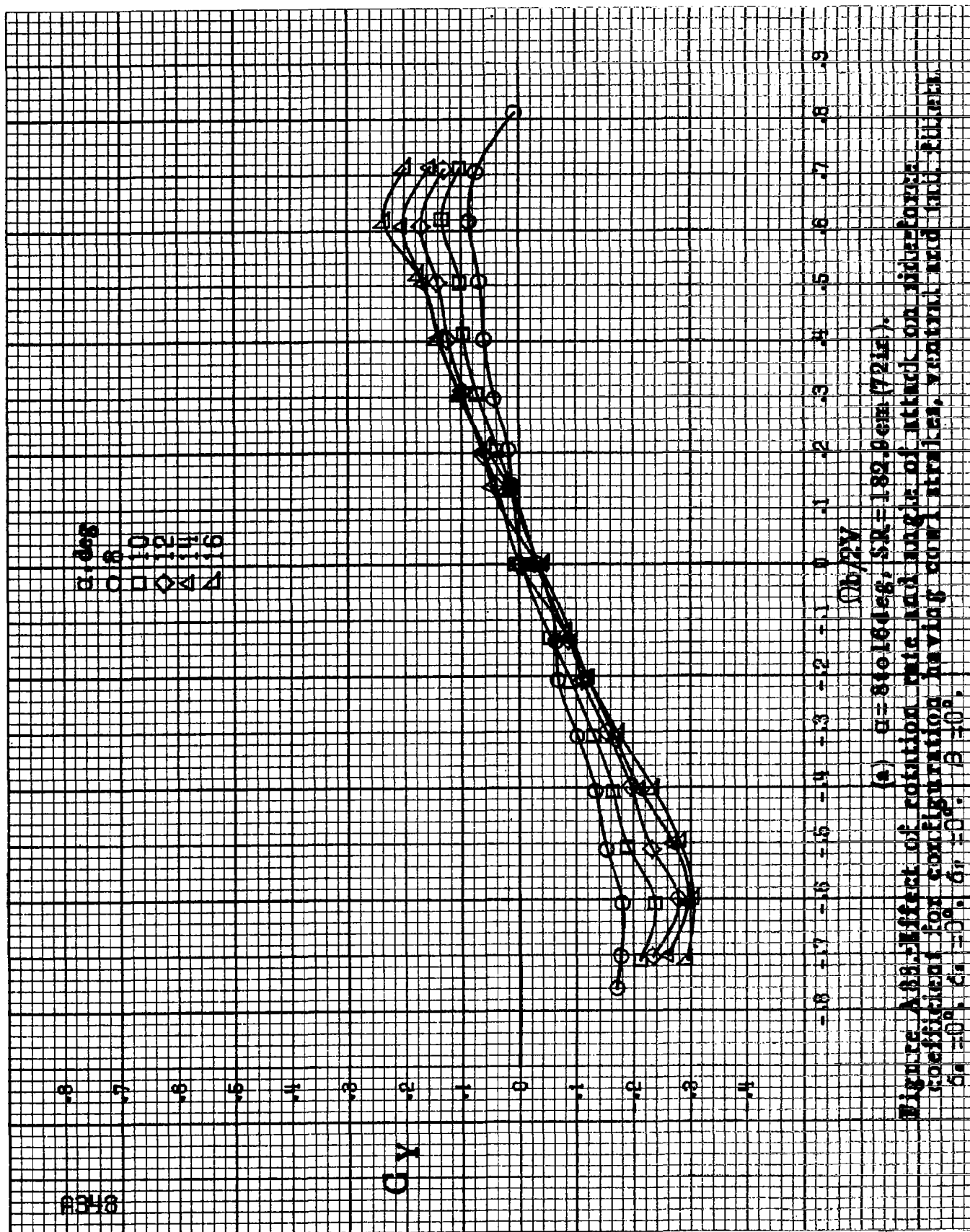
(b)  $U=18085$  deg,  $SR=182.9$  cm (72 in).  
Figure A105, Continued.



(c)  $\alpha = 30$  to  $50$  deg,  $SR = 0$ .  
Figure A106, Continued.



(d)  $\alpha = 55, 50, 70, 80, 90$  deg,  $SR = 0$ .  
Figure A 82. Concluded.

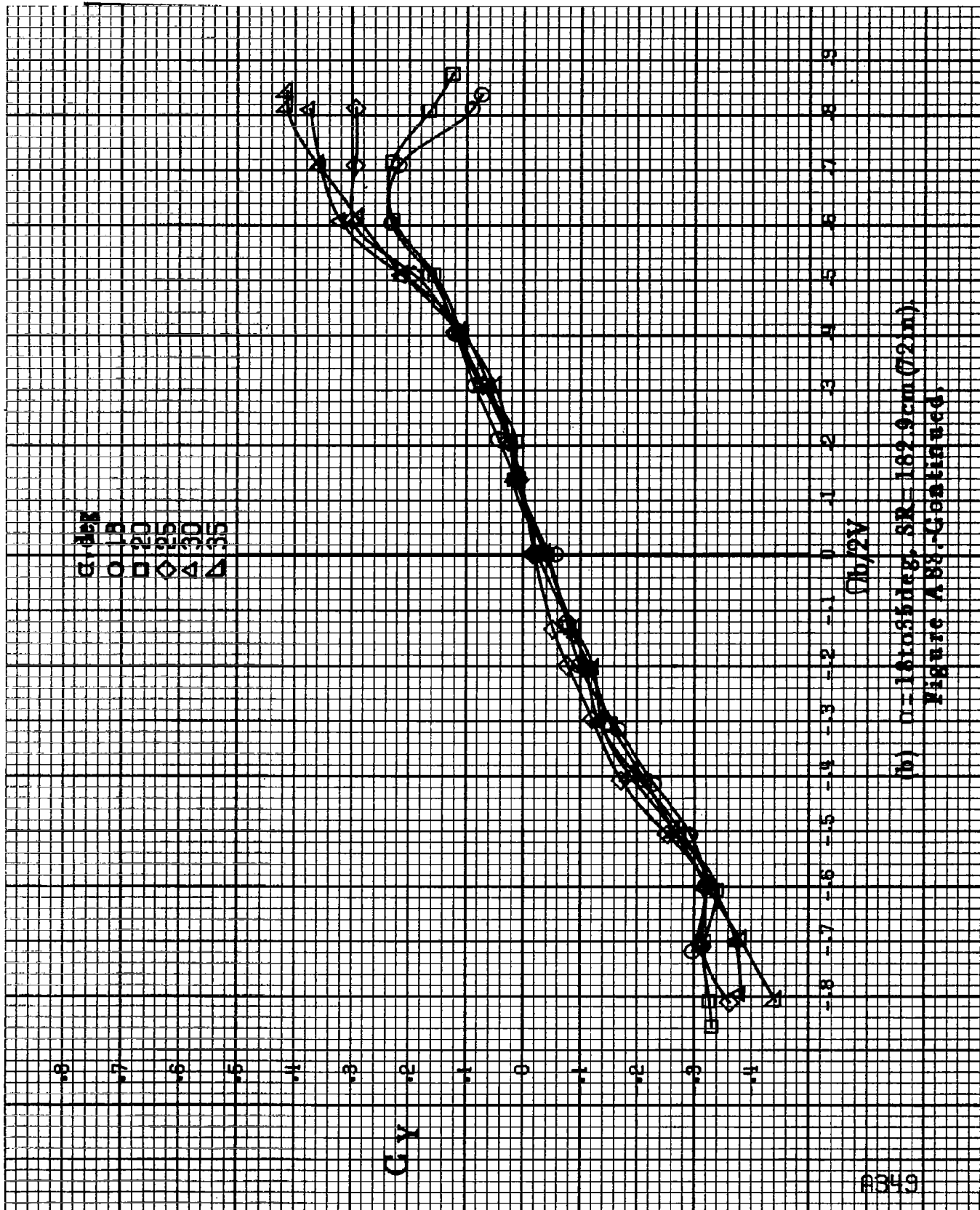


(a)  $\alpha = 84.164 \text{ deg}$ ,  $SR = 182.9 \text{ cm} (72 \text{ in})$ .

Figure A88. Effect of rotation rate and angle of attack on sideforce coefficient for configuration having conical strakes, ventral and tail fillets.

$\delta_a = 0^\circ$ ,  $\delta_r = 0^\circ$ ,  $\delta_v = 0^\circ$ ,  $\beta = 10^\circ$ .





(b)  $\alpha = 15$  to  $35$  deg,  $SR = 162.9 \text{ cm} (0.2 \text{ in})$   
Figure A88.-Continued.

8350

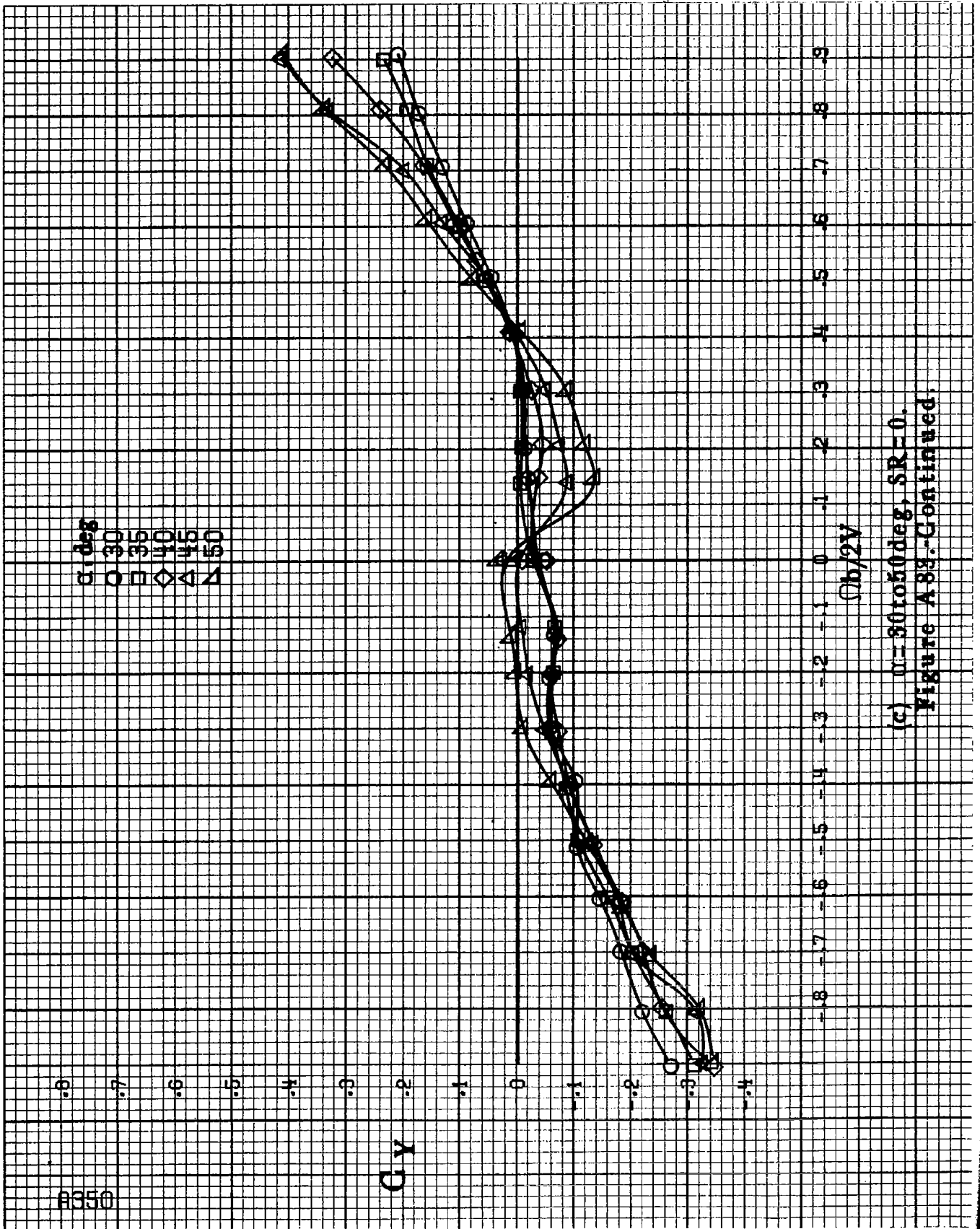
$\alpha$ , deg

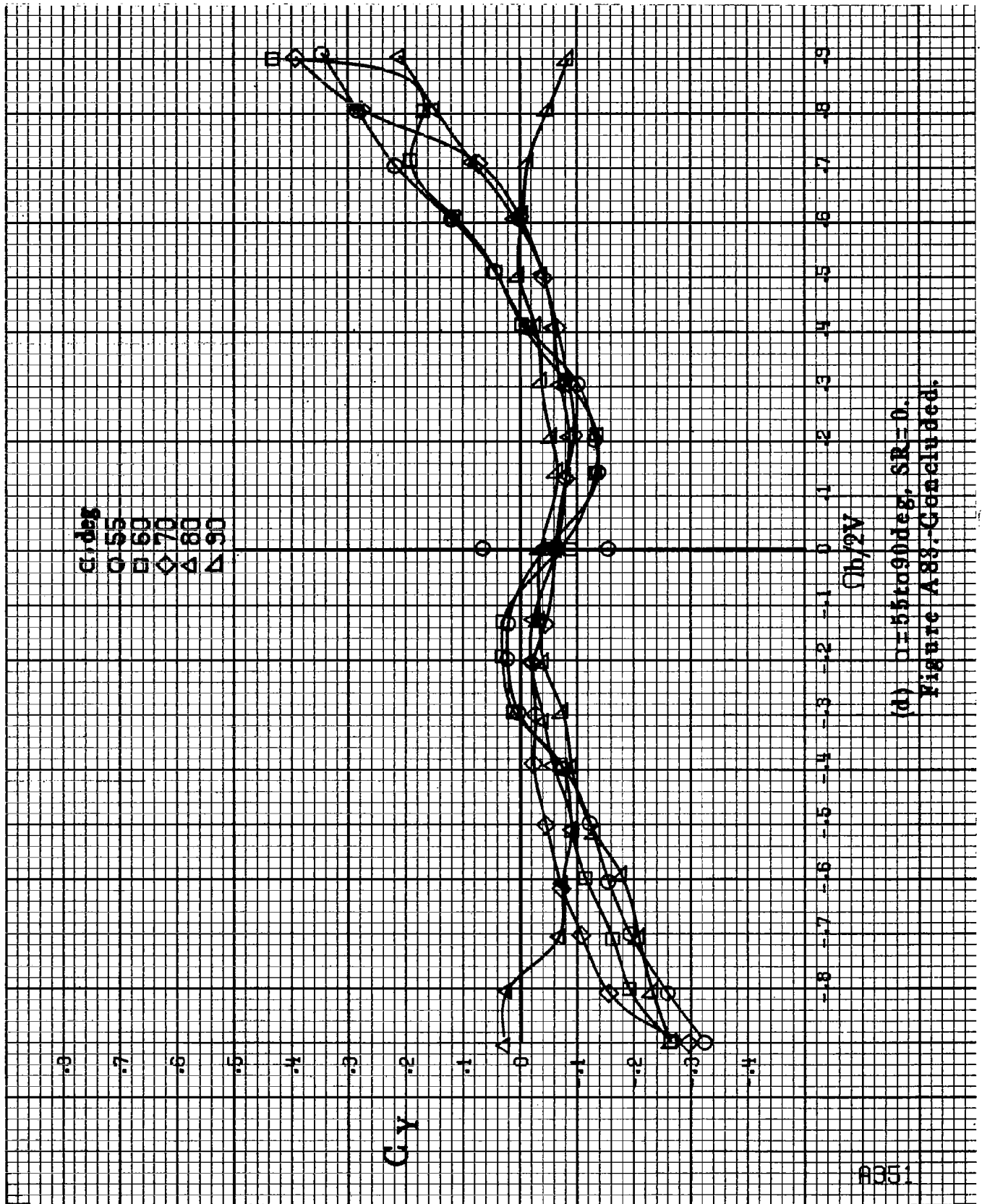
○ 30  
□ 35  
◇ 40  
△ 45  
▽ 50

$C_Y$

$Ob/2V$

(c)  $\alpha = 30$  to  $50$  deg,  $SR = 0$ .  
Figure A88-Continued.

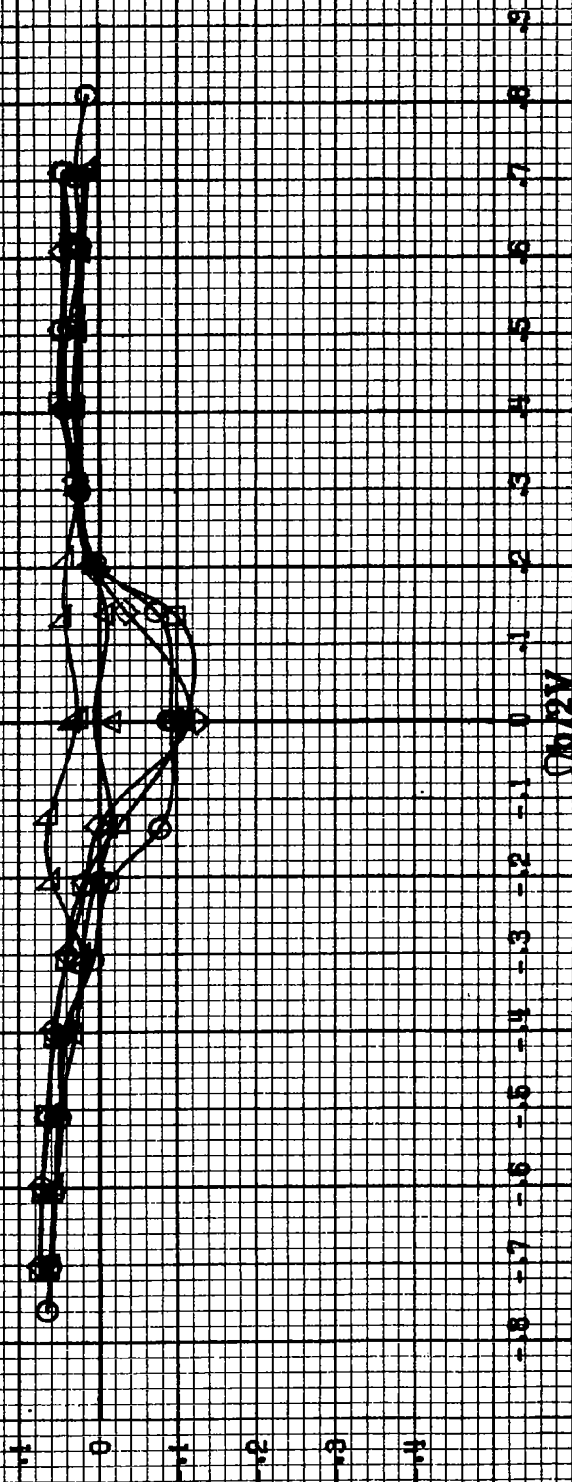




(d)  $\alpha = 55$  to  $90$  deg,  $SR = 0$ .  
Figure A88. Continued.

$\alpha, \text{deg}$ 

$\circ 8$   
 $\square 10$   
 $\diamond 12$   
 $\triangle 14$   
 $\nabla 16$

 $C_A$ 

(a)  $\alpha = 8$  to  $16$  deg,  $SR = 1.82$  per (72 in).

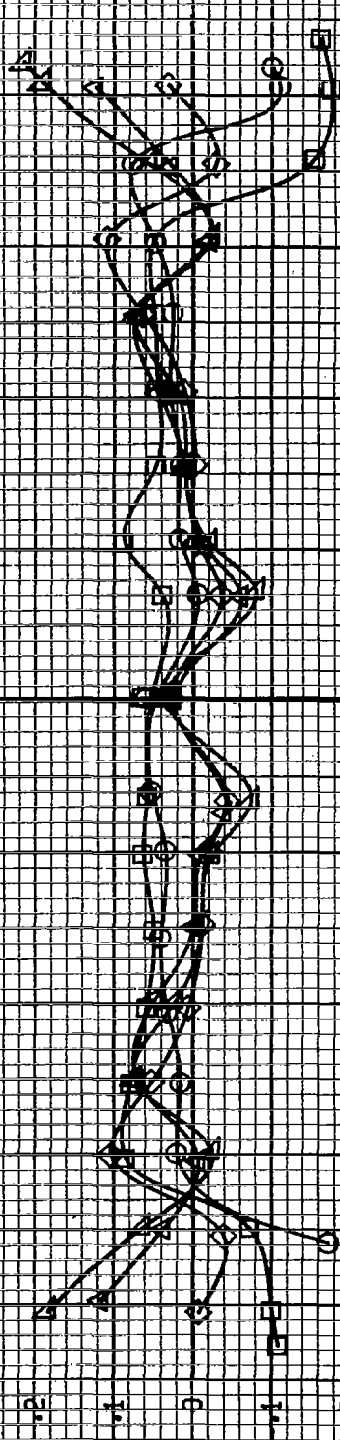
Figure 884. Effect of rotation rate and angle of attack on axial force coefficient for configuration having cow strikes, ventral and tail fillets.  $\delta_1 = 0^\circ$ ,  $\delta_2 = 0^\circ$ ,  $\delta_3 = 0^\circ$ ,  $\delta_4 = 0^\circ$ ,  $\delta_5 = 0^\circ$ .

$\Delta$  0.65  
 $\circ$  0.15  
 $\square$  0.20  
 $\diamond$  0.25  
 $\nabla$  0.30  
 $\triangle$  0.35

Cl A

$\phi_{H/2V}$

(b)  $\mu = 16.035 \text{ deg}$ ,  $SR = 162.9 \text{ cm (72 in.)}$   
 Figure A84-Continued.



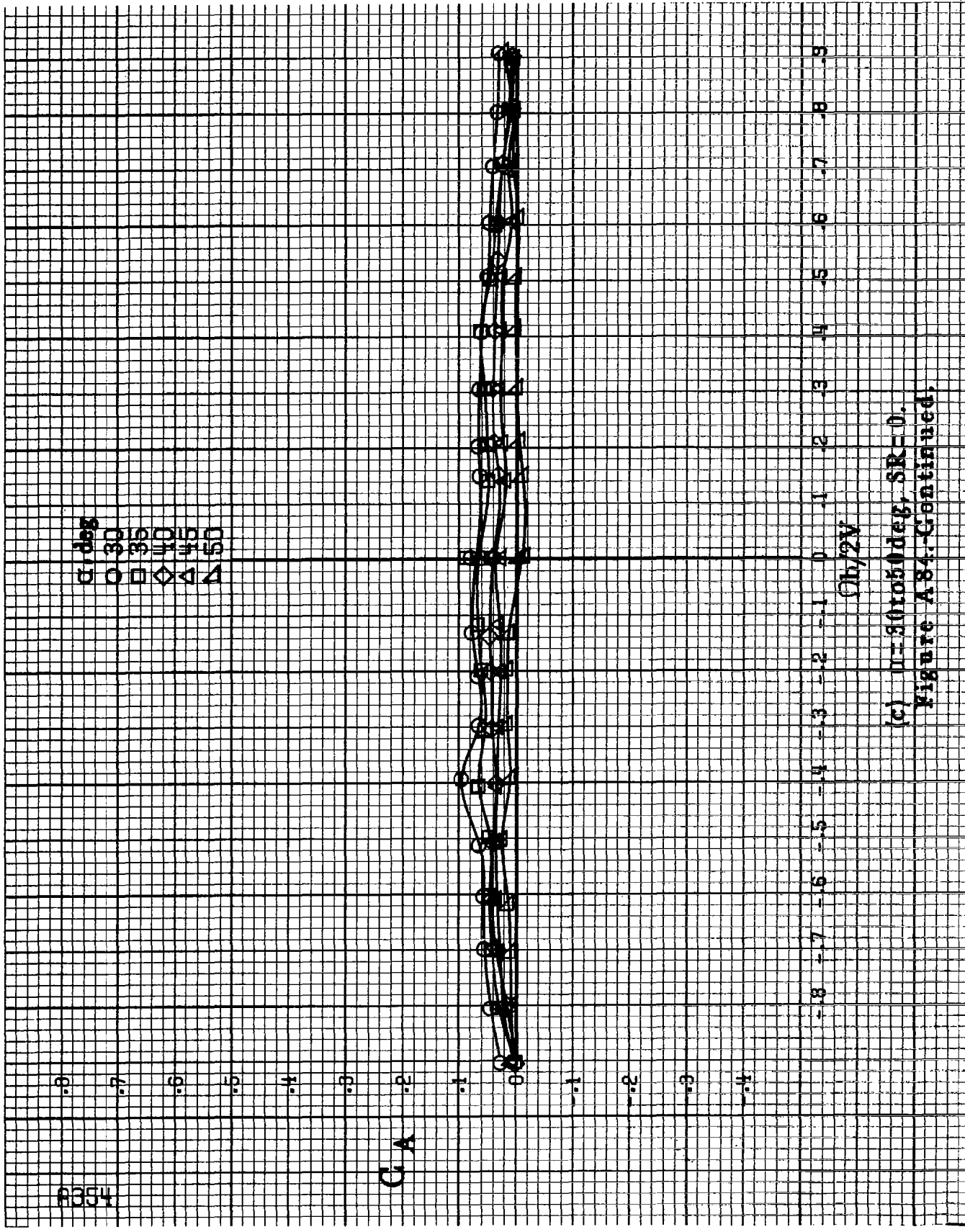
80354

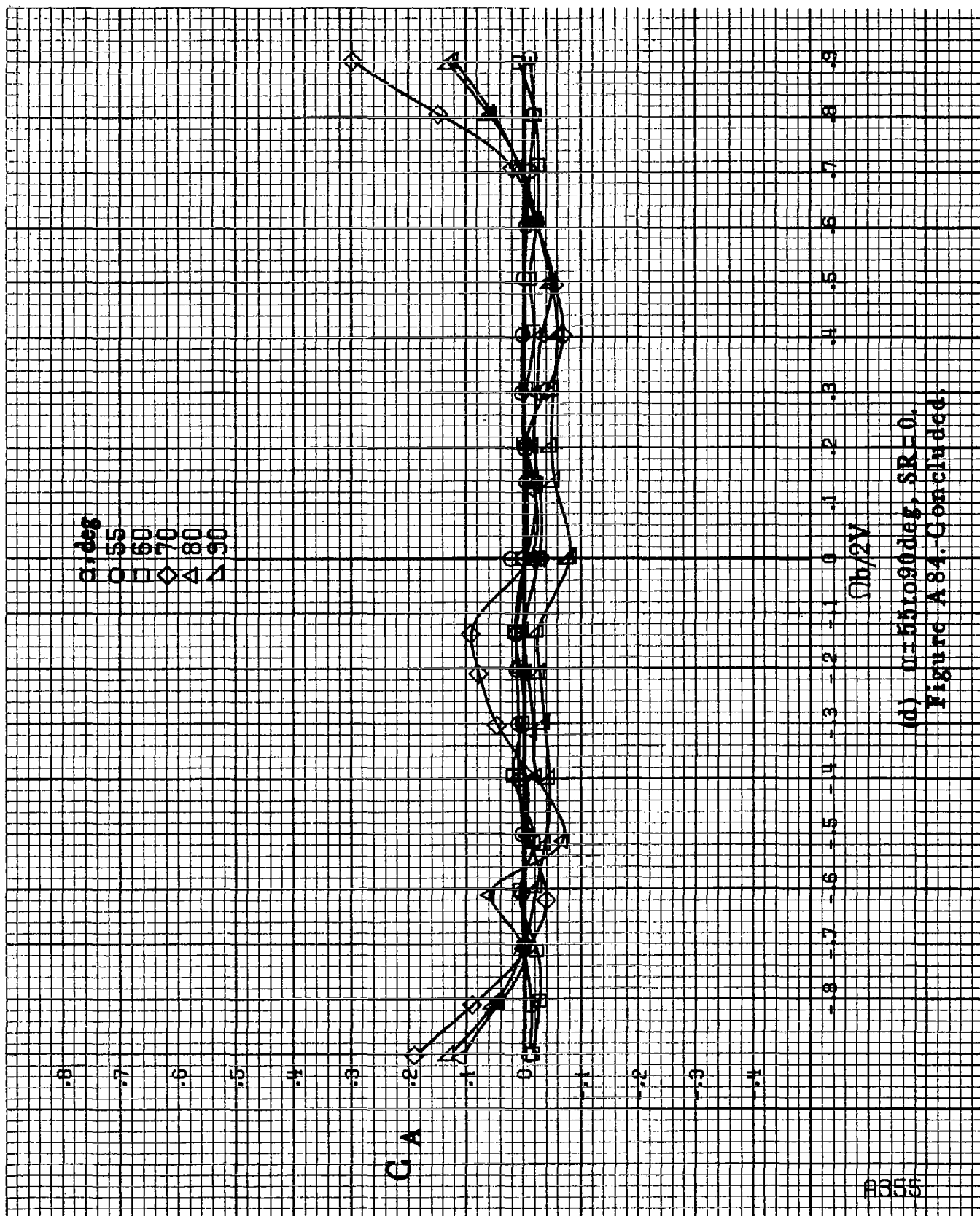
$\alpha$ , deg  
 ○ 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▲ 50

$C_A$

$\Omega_b/2V$

(c)  $U=30$  to  $50$  deg,  $SR=0$ .  
 Figure A84-Continued.





(d)  $\alpha = 55$  to  $90$  deg,  $SR = 0$ .  
Figure A 84. Concluded.

$\alpha$ , deg

○ 8  
□ 10  
◇ 12  
△ 14  
▲ 16

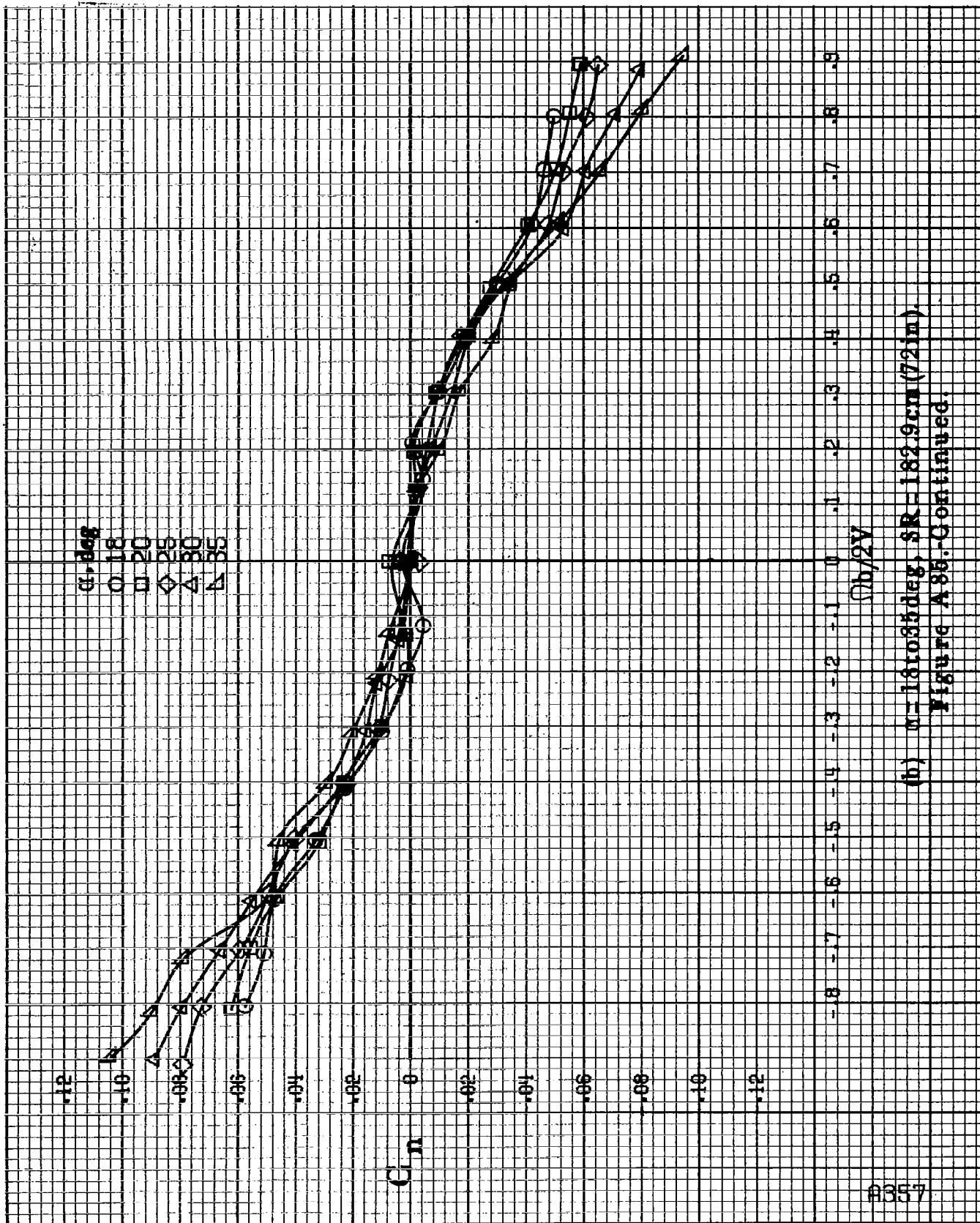
$C_n$

$m_b/2V$

(a)  $\alpha = 8$  to  $16$  deg,  $SR = 132.9$  cm (72 in).

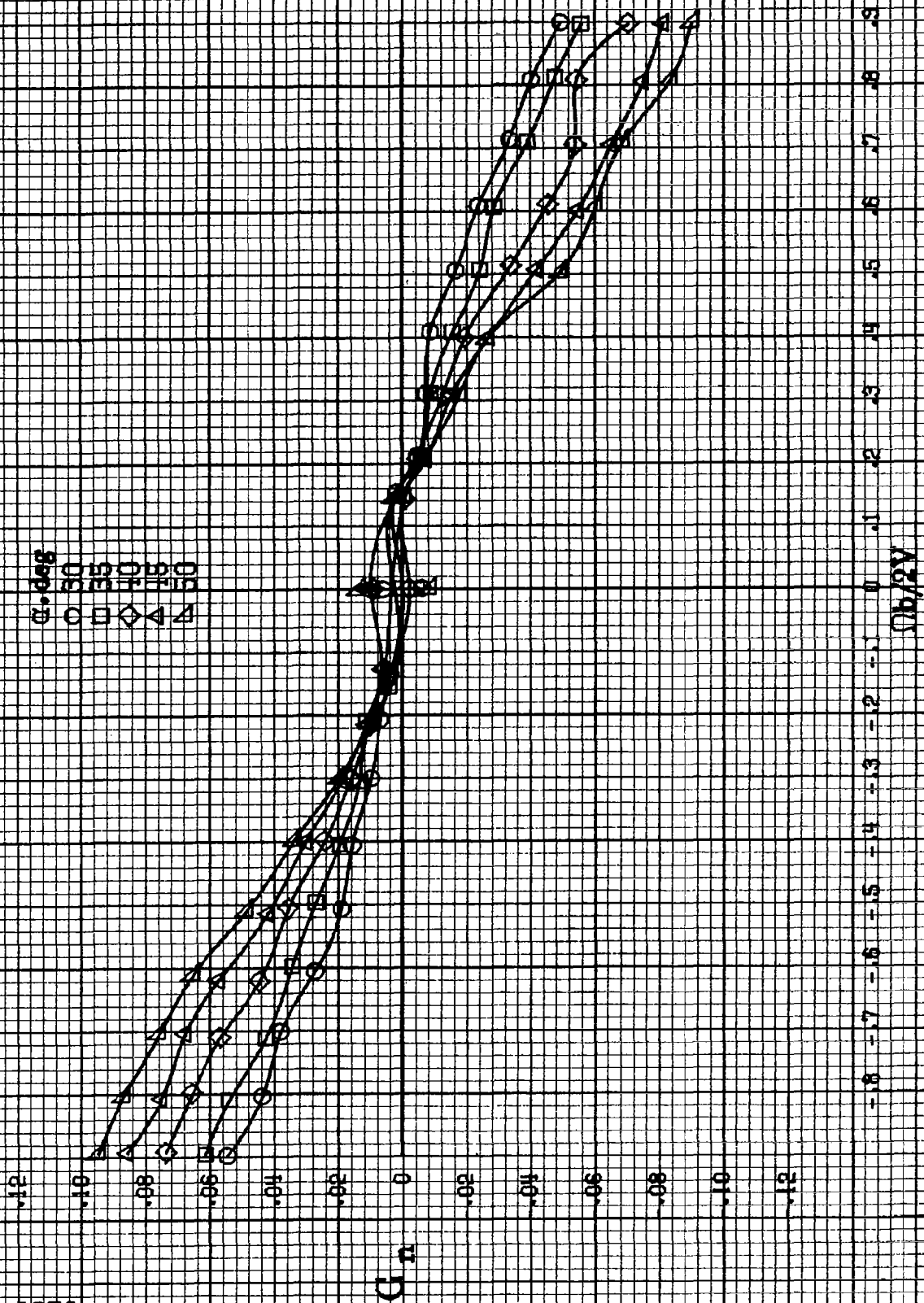
Figure A8b. Effect of rotation rate and angle of attack on yawing moment coefficient for horizontal tail off configuration,  $\delta_e = 0^\circ$ ,  $\delta_a = 0^\circ$ ,  $\delta_r = 0^\circ$ ,  $B = 0^\circ$ .



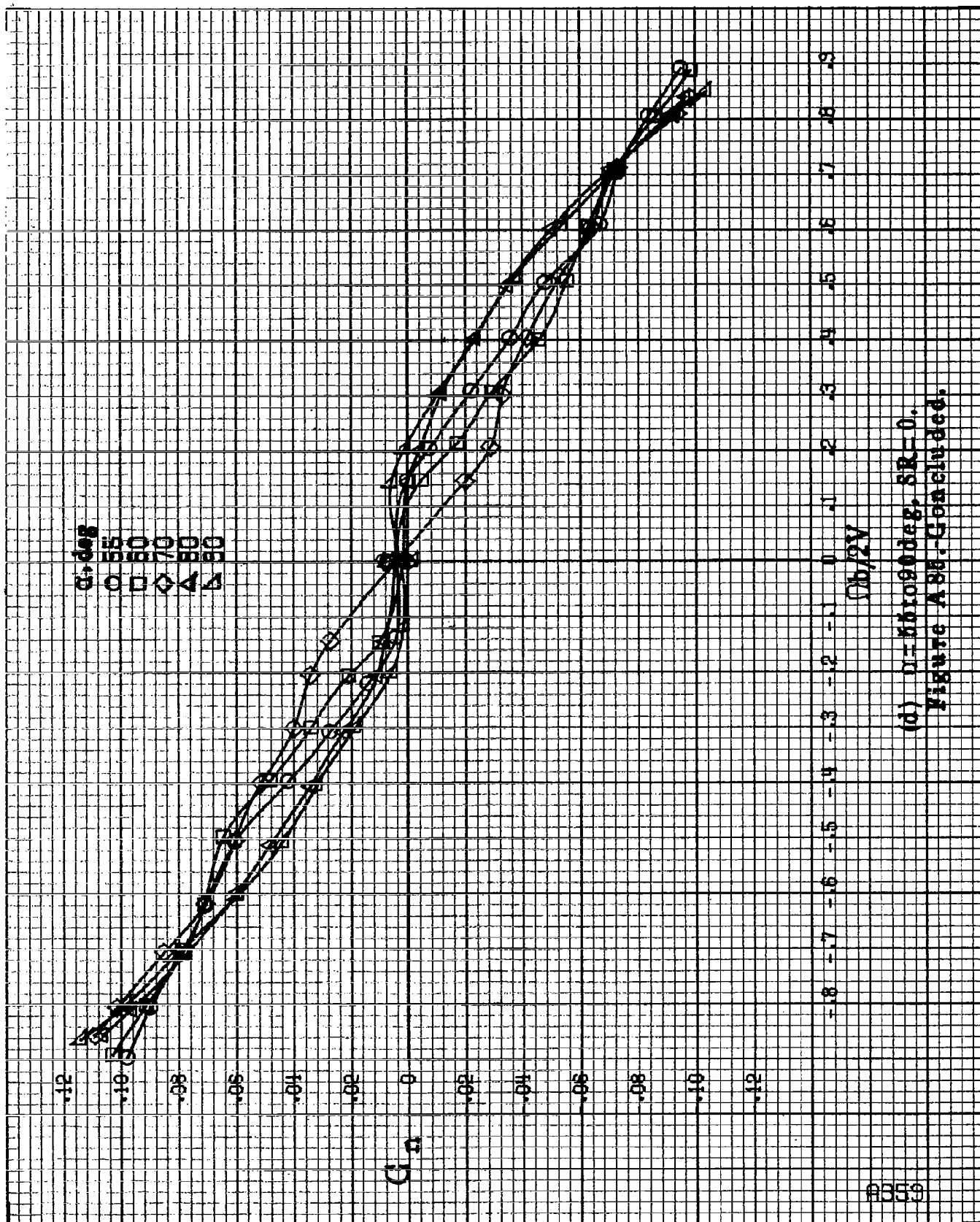


8357

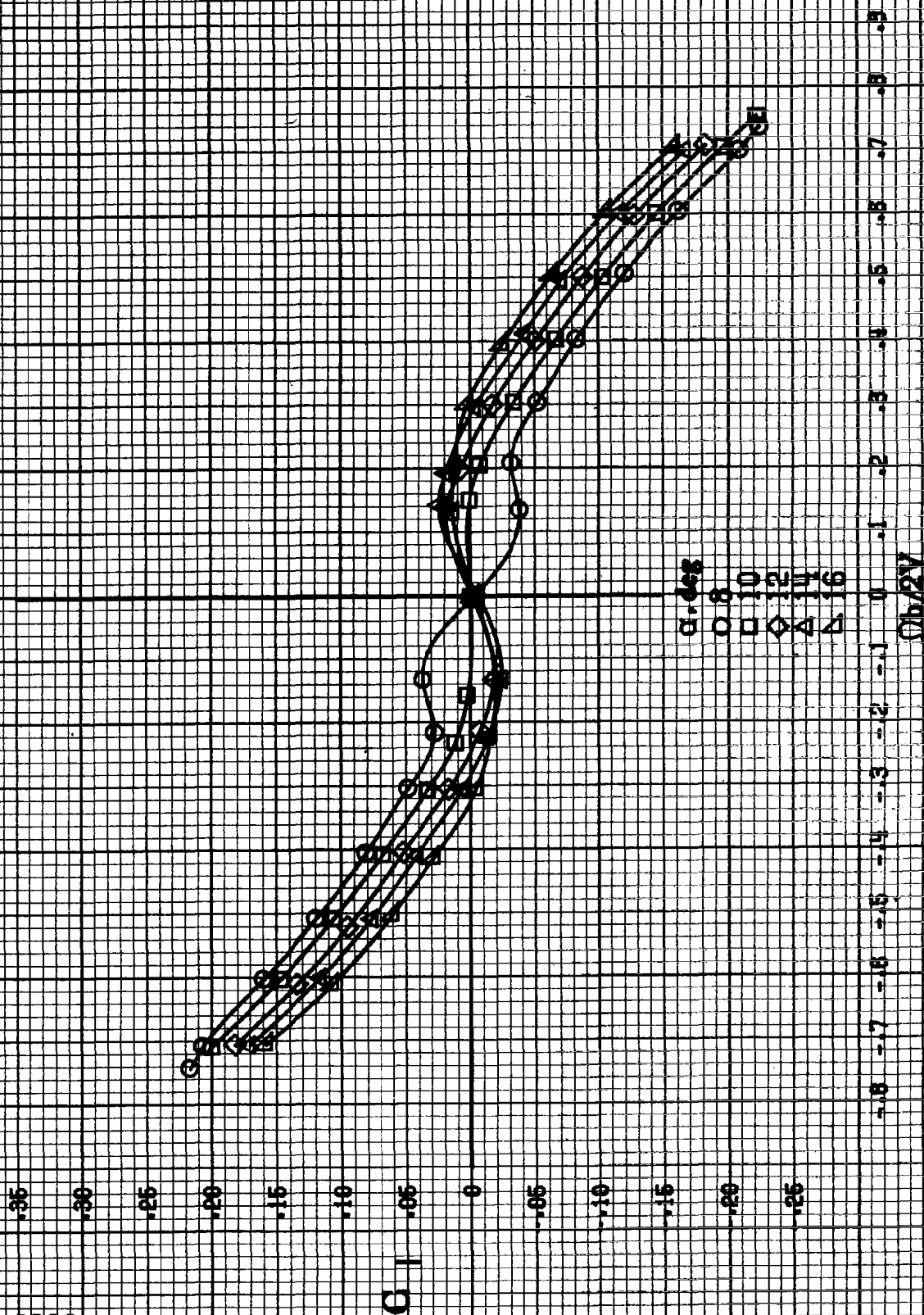
(b)  $\alpha=16$  to  $35$  deg, SR-182.9cm (72in).  
Figure A85-Continued.



(c)  $\omega=80$  to  $800$  deg,  $SR=0$ .  
Figure A8B-Continued.

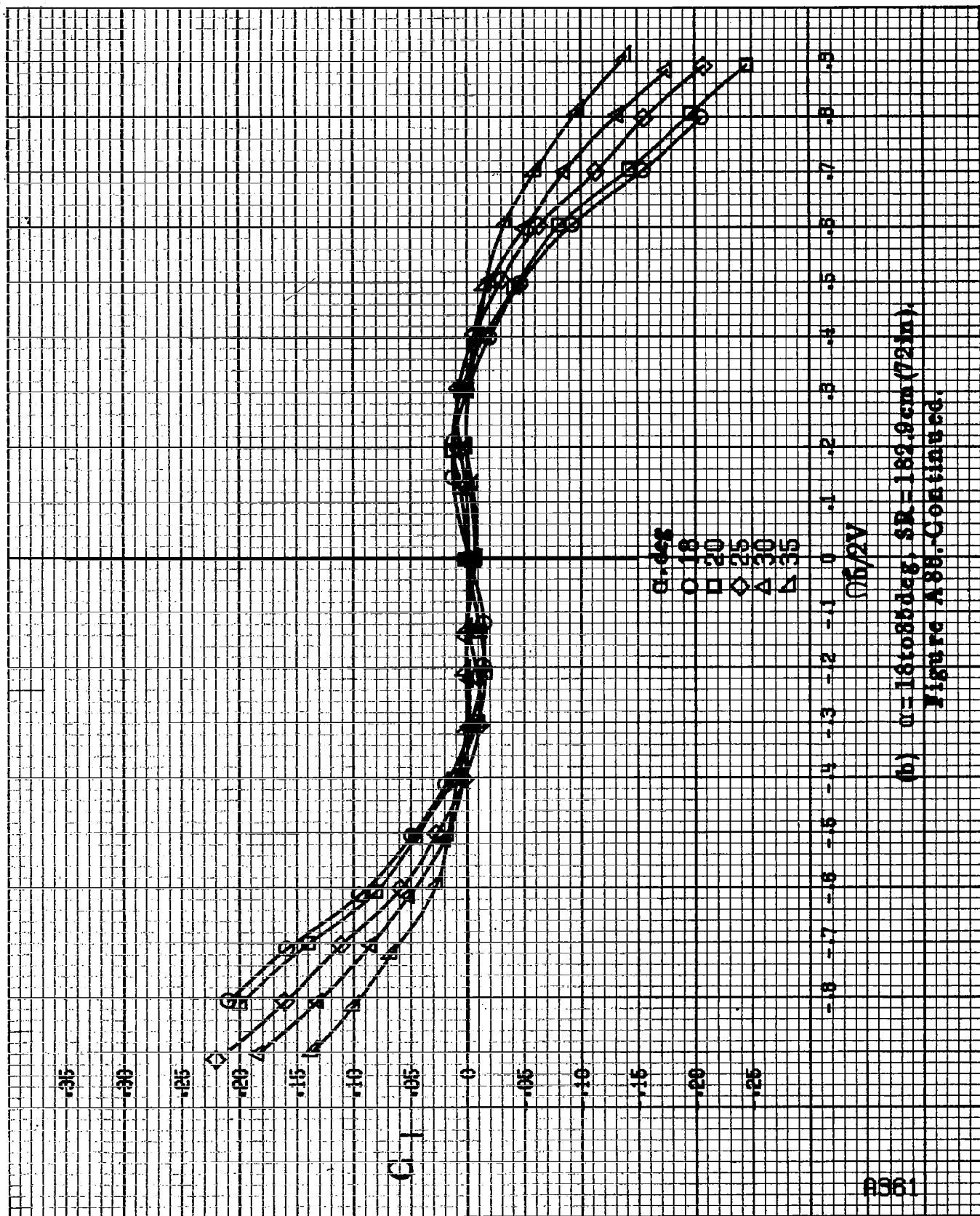


(d)  $\alpha = 55$  to  $90$  deg,  $SR = 0$ .  
Figure A88.-Continued.



(a)  $\alpha = 8$  to  $16$  deg,  $SR = 1.82$ ,  $Re_m = 7.2 \times 10^6$ .

Figure A86: Effect of rotation rate and angle of attack on rolling-moment coefficient for horizontal tail off configuration.  $\delta_e = 0^\circ$ ,  $\delta_a = 0^\circ$ ,  $\delta_r = 0^\circ$ .



(b)  $\alpha = 18$  to  $85^\circ$ ,  $SR = 182.9$  cm (72 in).  
Figure A88-Continued.

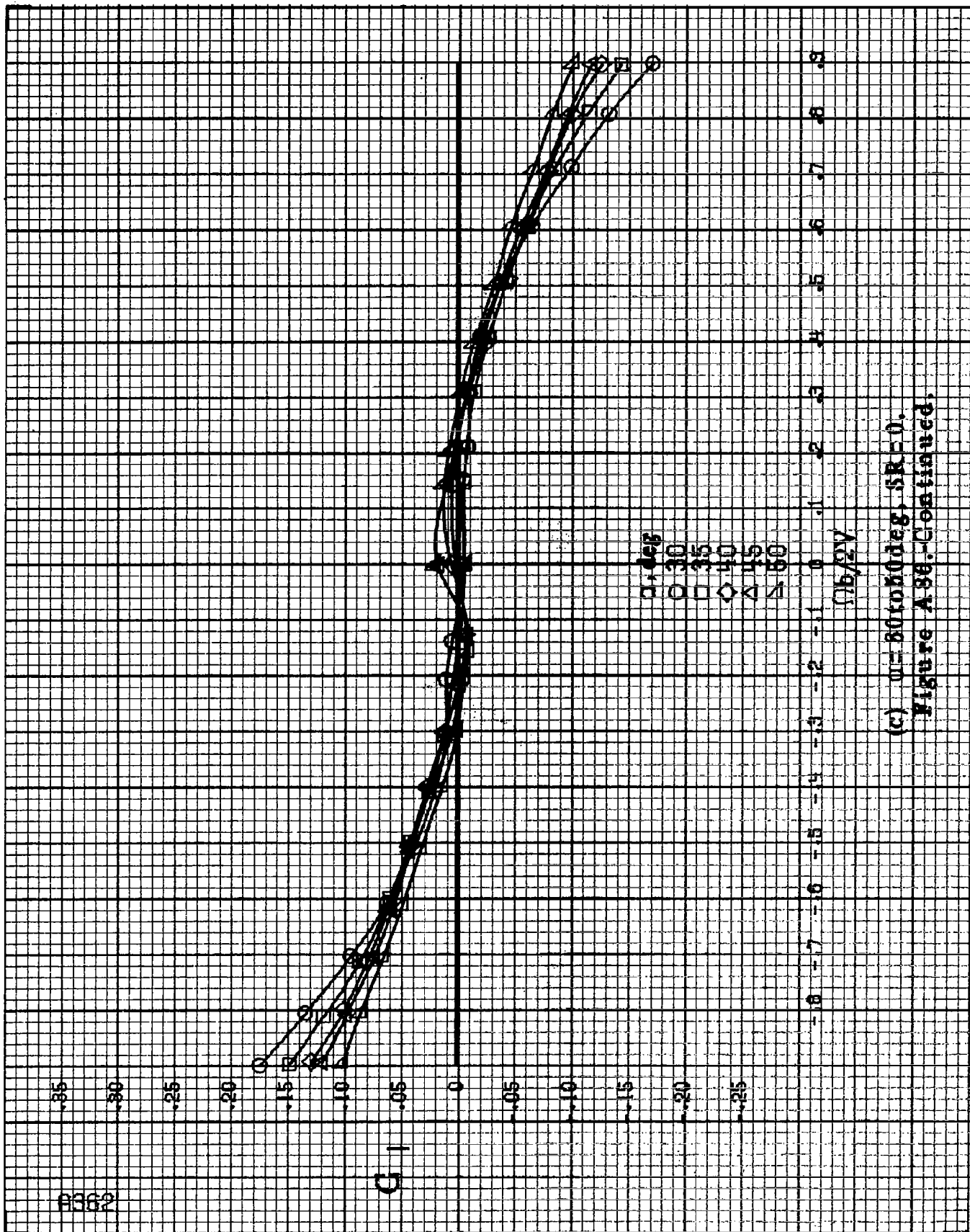
B362

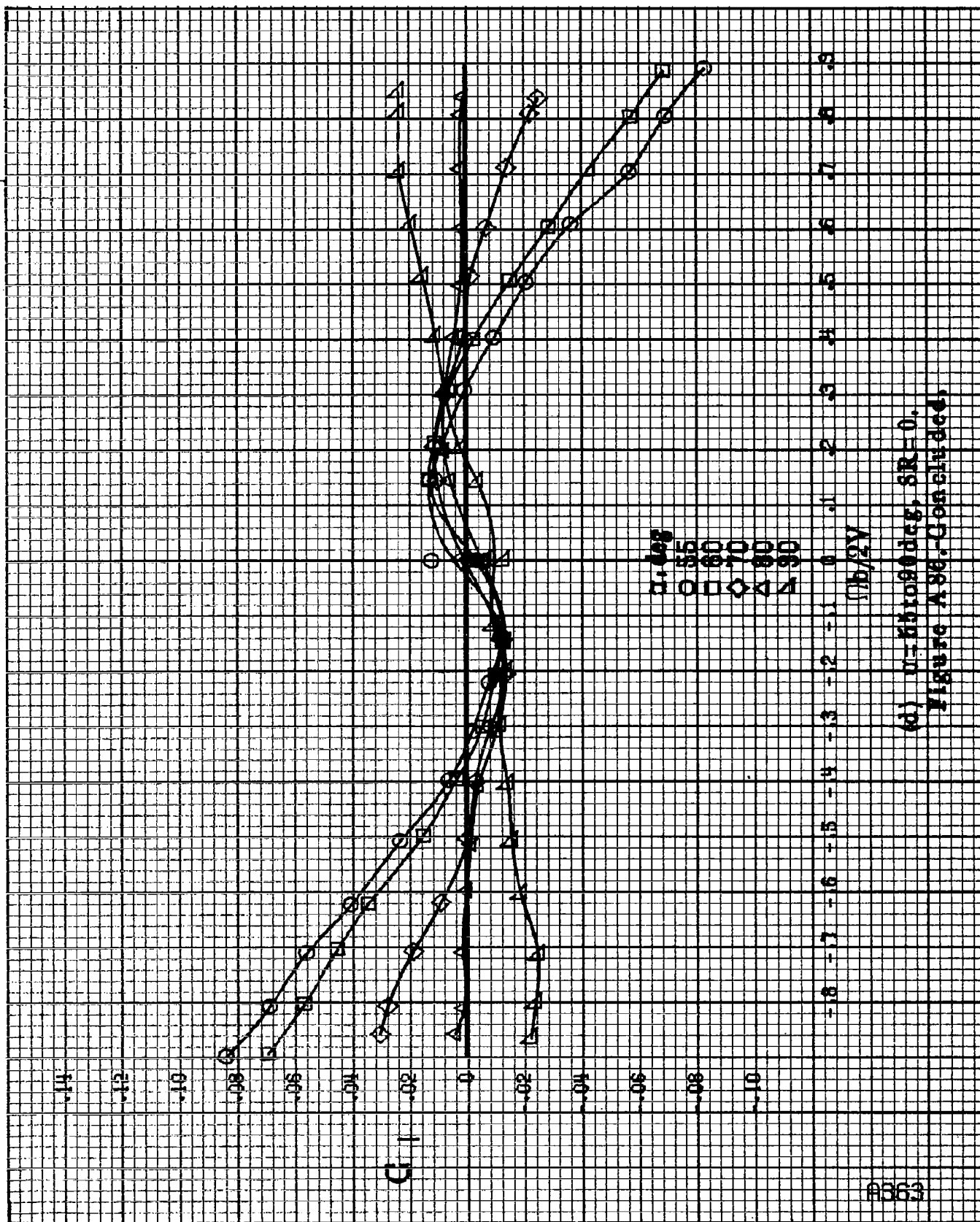
$C_1$

$\alpha, \text{deg}$   
 ○ 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▲ 50

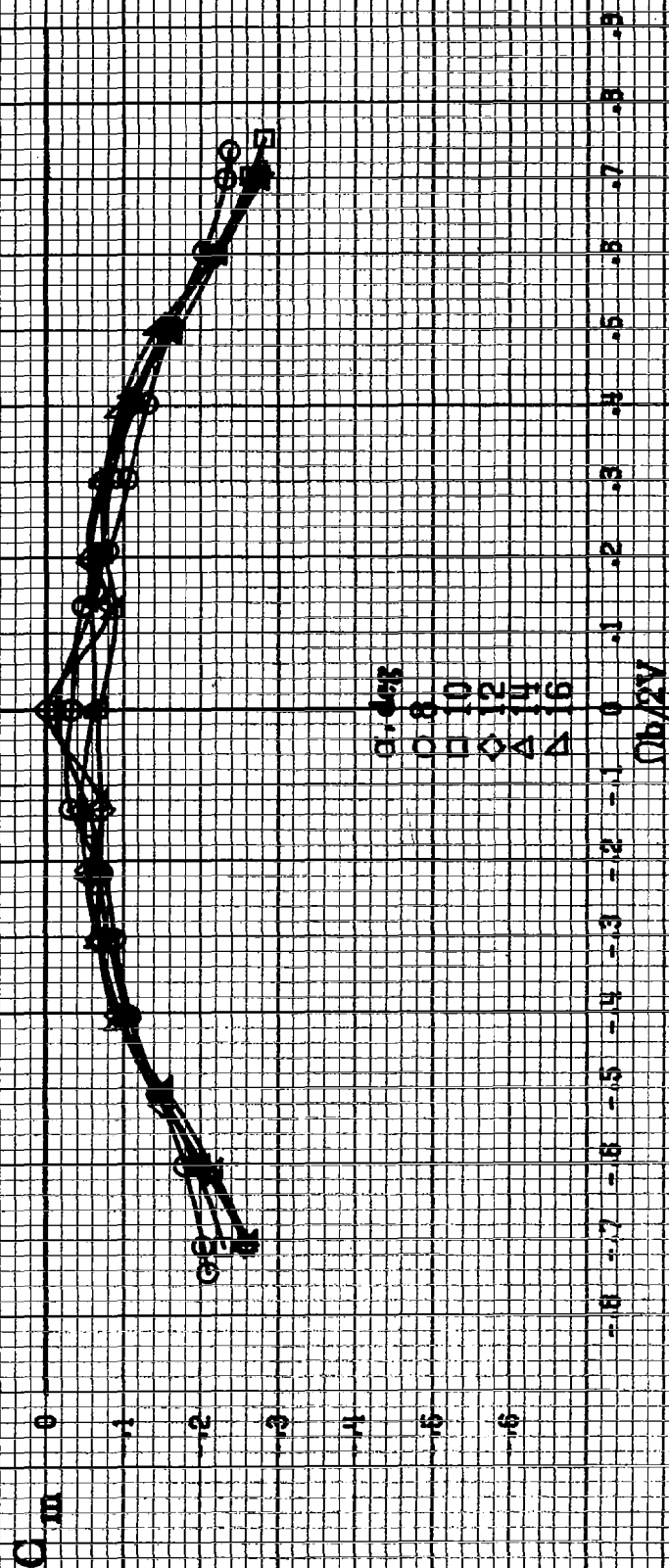
$\Omega b / 2V$

(c)  $\Omega = 80 \text{ to } 800 \text{ deg}$ ,  $SR = 0$ .  
 Figure A36-Continued.



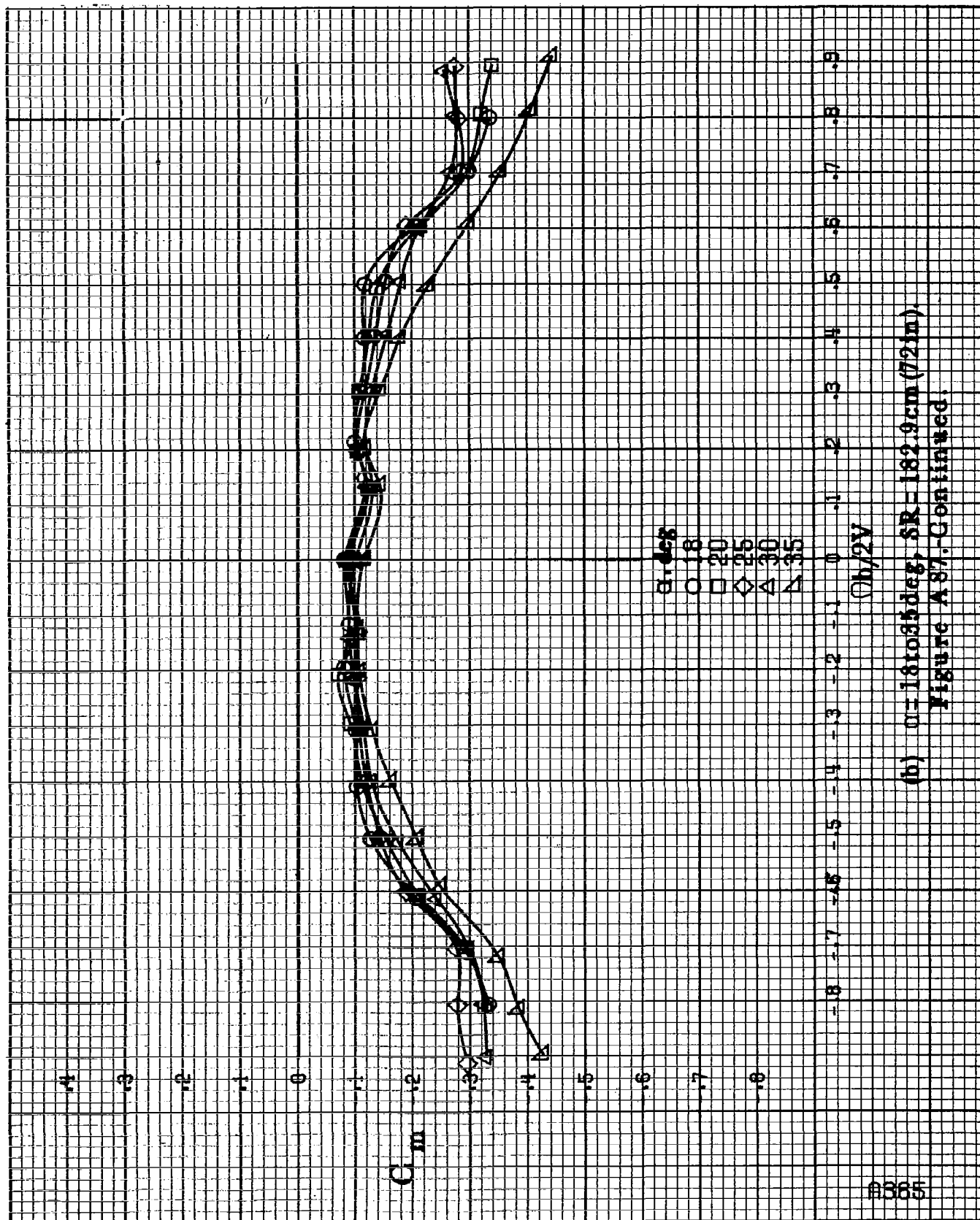


(d)  $\mu = 60^\circ$ ,  $SR = 0$ .  
Figure A88-Continued.



(a)  $\alpha = 8$  to  $16$  deg,  $SR = 182.9$  cm ( $72$  in.).  
 Figure A87. Effect of rotation rate and angle of attack on pitching moment coefficient for horizontal tail off configuration.  $\delta_a = 0^\circ$ ,  $\delta_e = 0^\circ$ ,  $\delta_r = 0^\circ$ .





8365

(b)  $\alpha = 18$  to  $35^\circ$ ,  $SR = 182.9 \text{ cm (72 in.)}$   
Figure A87.-Continued.

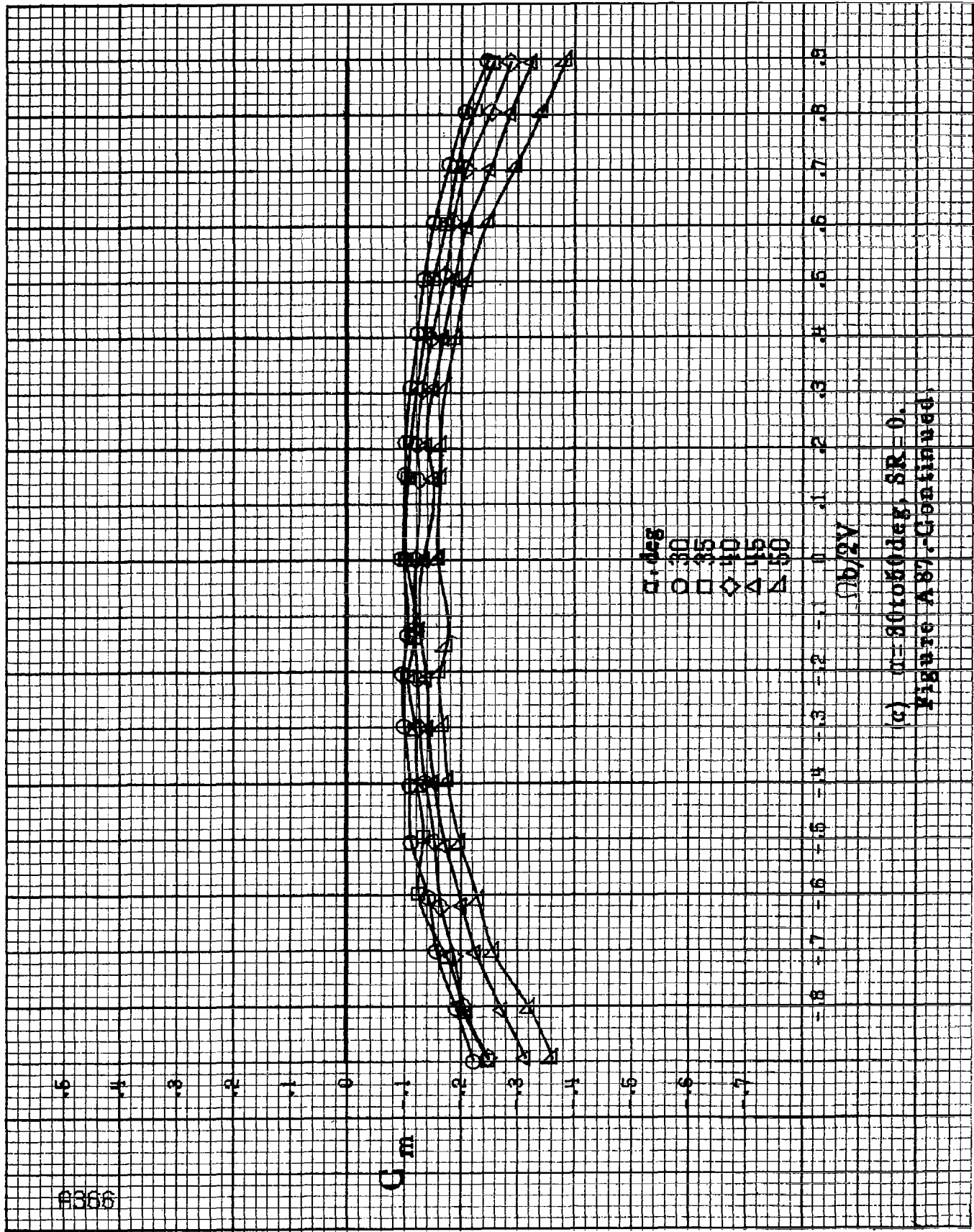
$C_m$

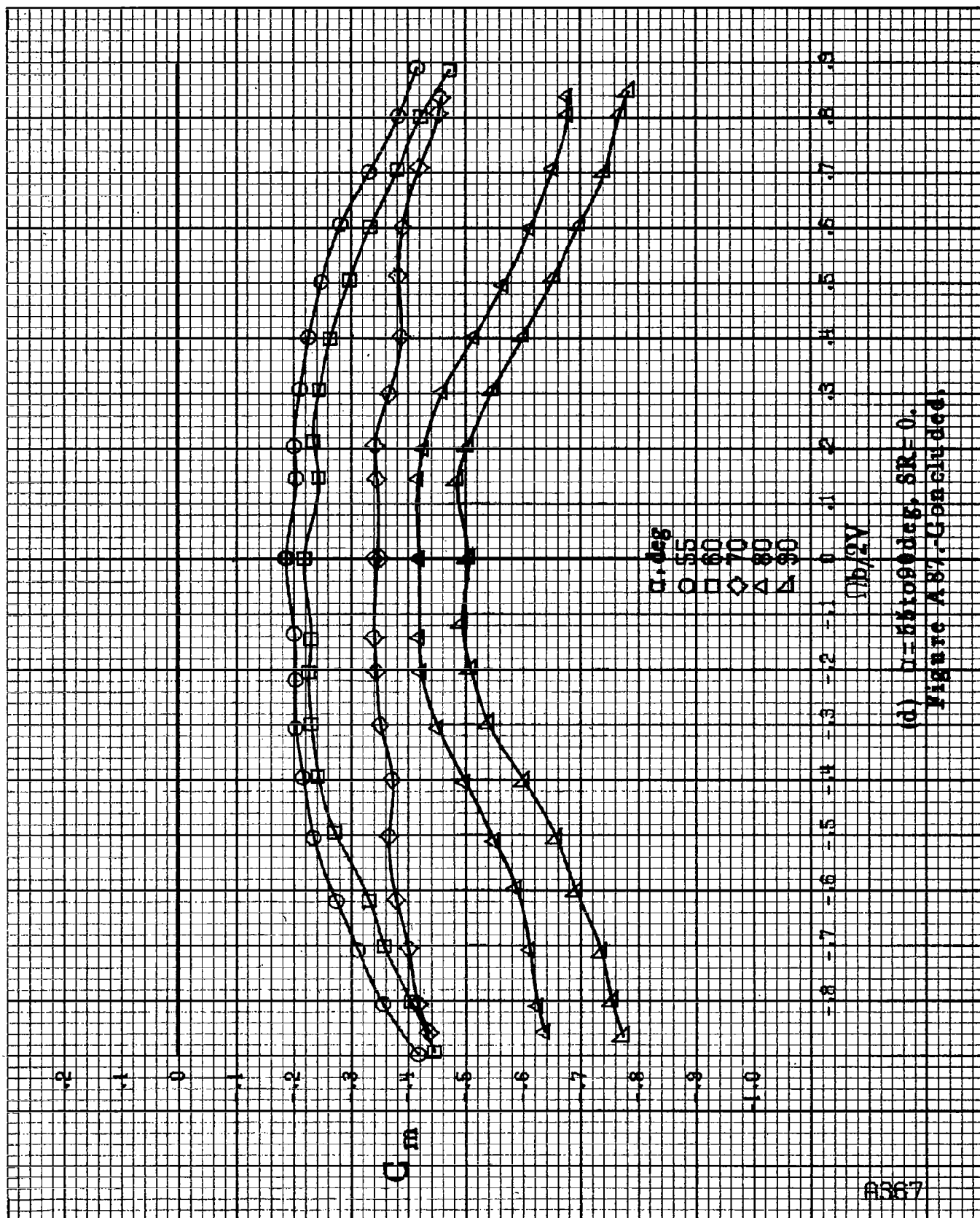
$\alpha, \text{deg}$

○ 30  
□ 35  
◇ 40  
△ 45  
▽ 50

$Ob/2V$

(c)  $\mu = 90$  to  $60$  deg,  $SR = 0$ .  
Figure A87.-Continued.



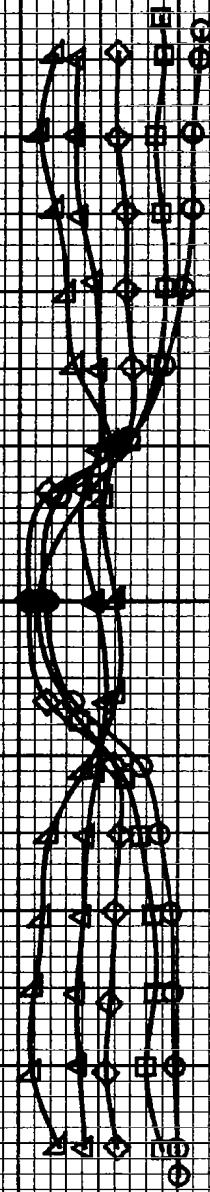


(d)  $\alpha = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A.87.-Continued.

8368

$\alpha, \text{deg}$   
 8  
 10  
 12  
 14  
 16

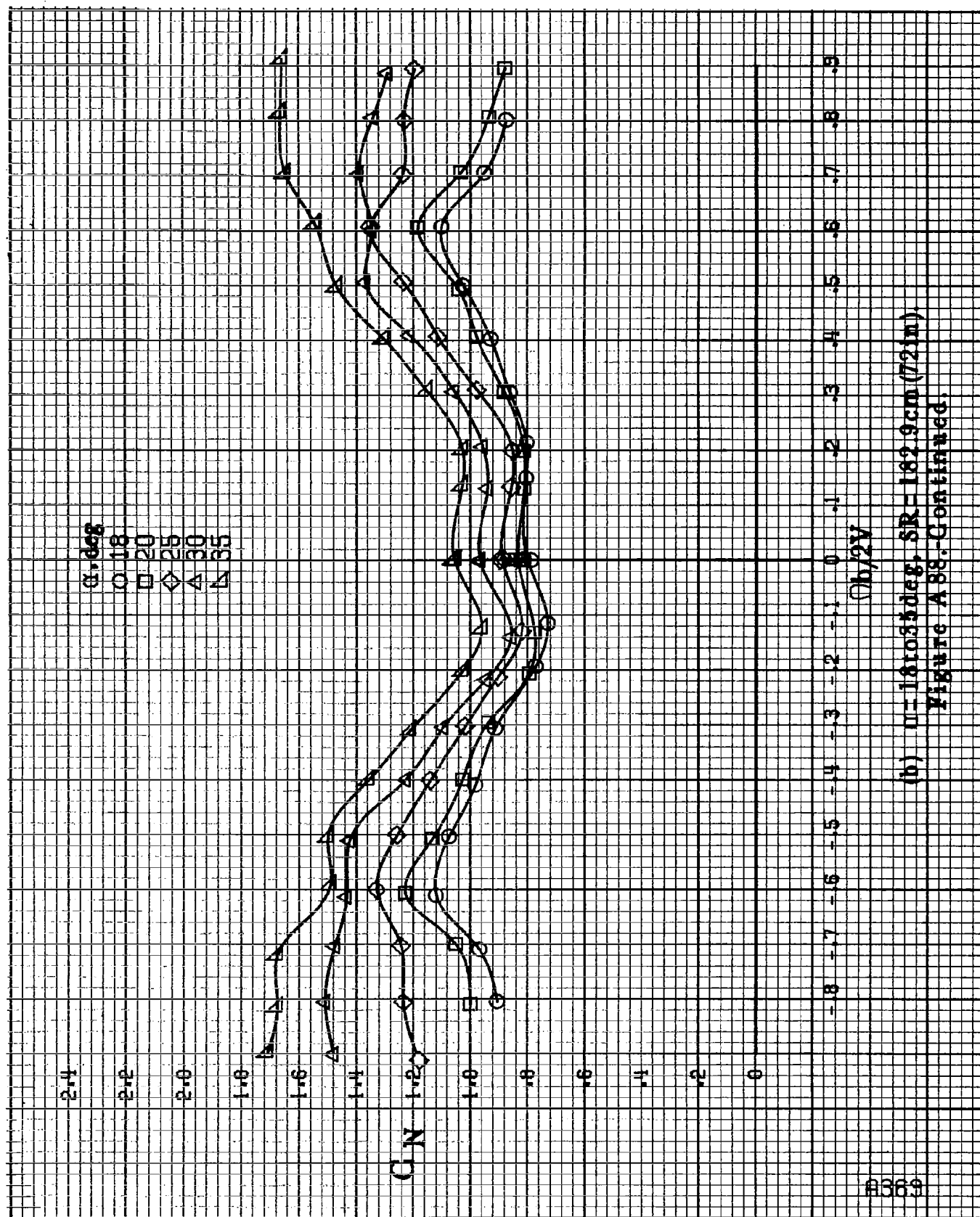
CN



$Ob/2V$

(a)  $\alpha = 8$  to  $16 \text{ deg}$ ,  $SR = 182.9 \text{ cm}$  (72 in).

Figure A88. Effect of rotation rate and angle of attack on normalized force coefficient for horizontal tail off configuration,  $\delta_a = 0^\circ$ ,  $\delta_i = 0^\circ$ ,  $\beta = 0^\circ$ .



(b)  $\alpha = 18$  to  $35$  deg,  $SR = 182.9$  cm (72 in).  
Figure A88. Continued.

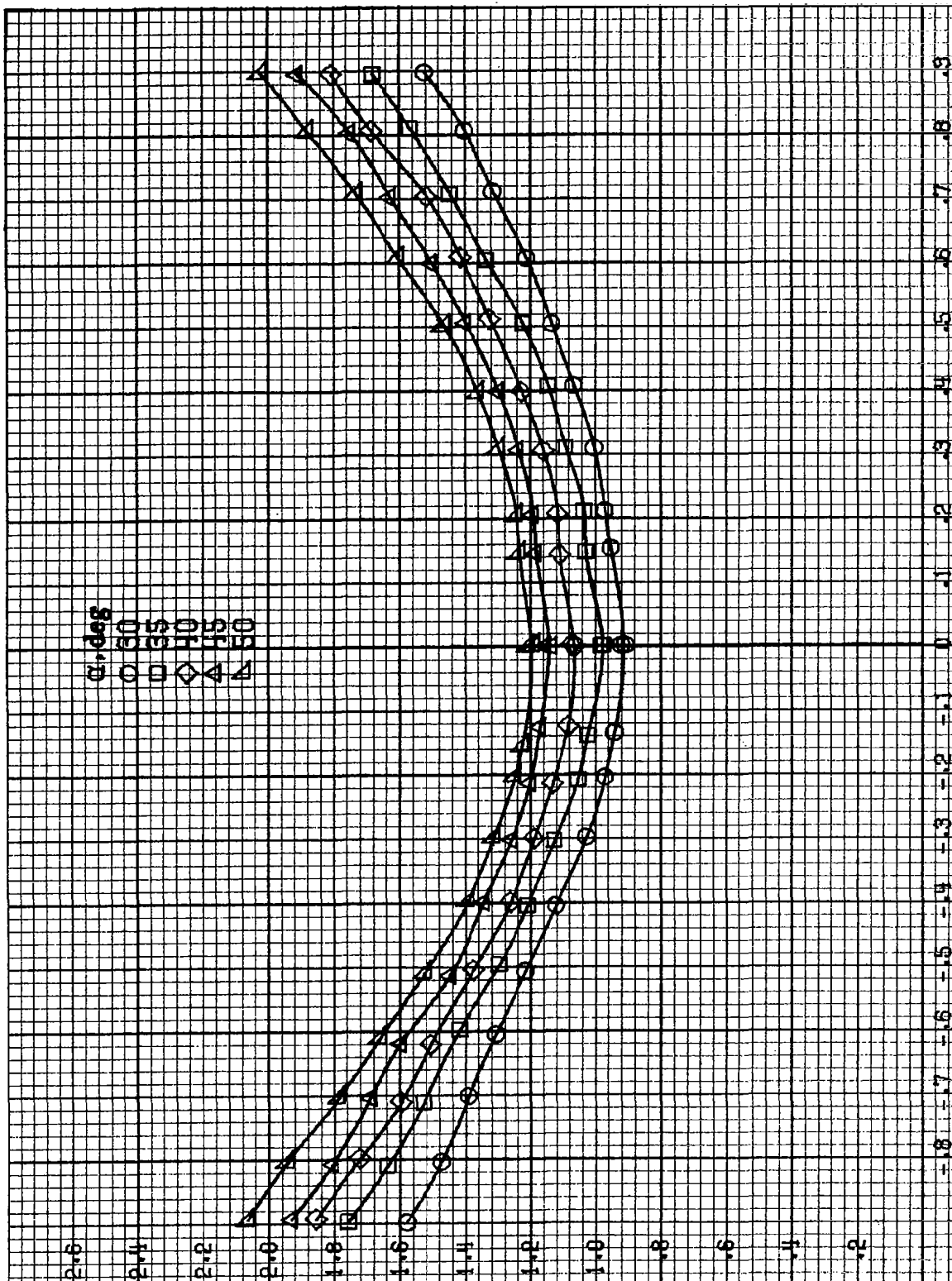
A370

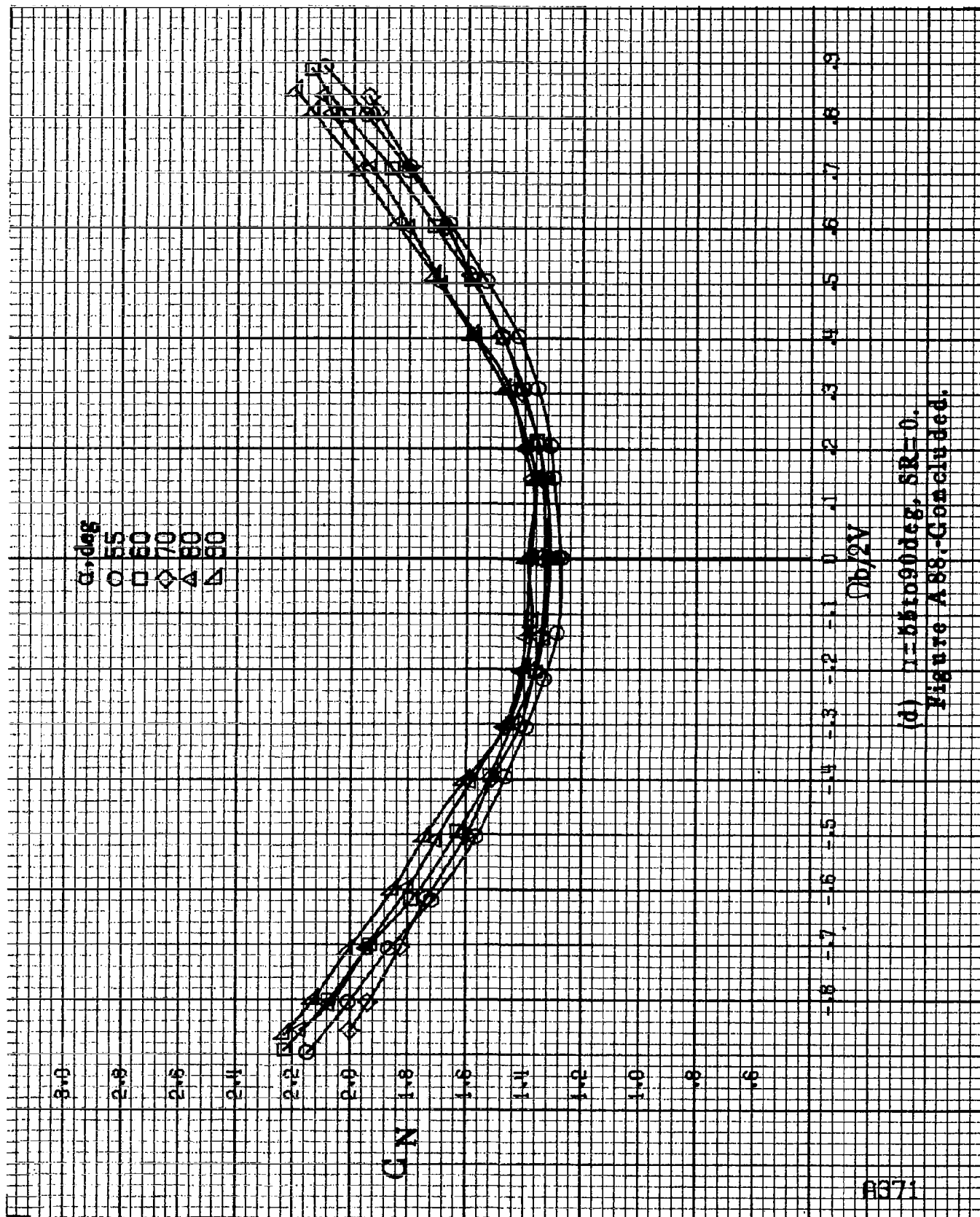
$\alpha, \text{deg}$   
 0 30 35 40 45 50

CN

$\phi_b/2V$

(c)  $\mu = 30 \text{ to } 50 \text{ deg}$ ,  $SR = 0$ .  
 Figure A88-Continued.



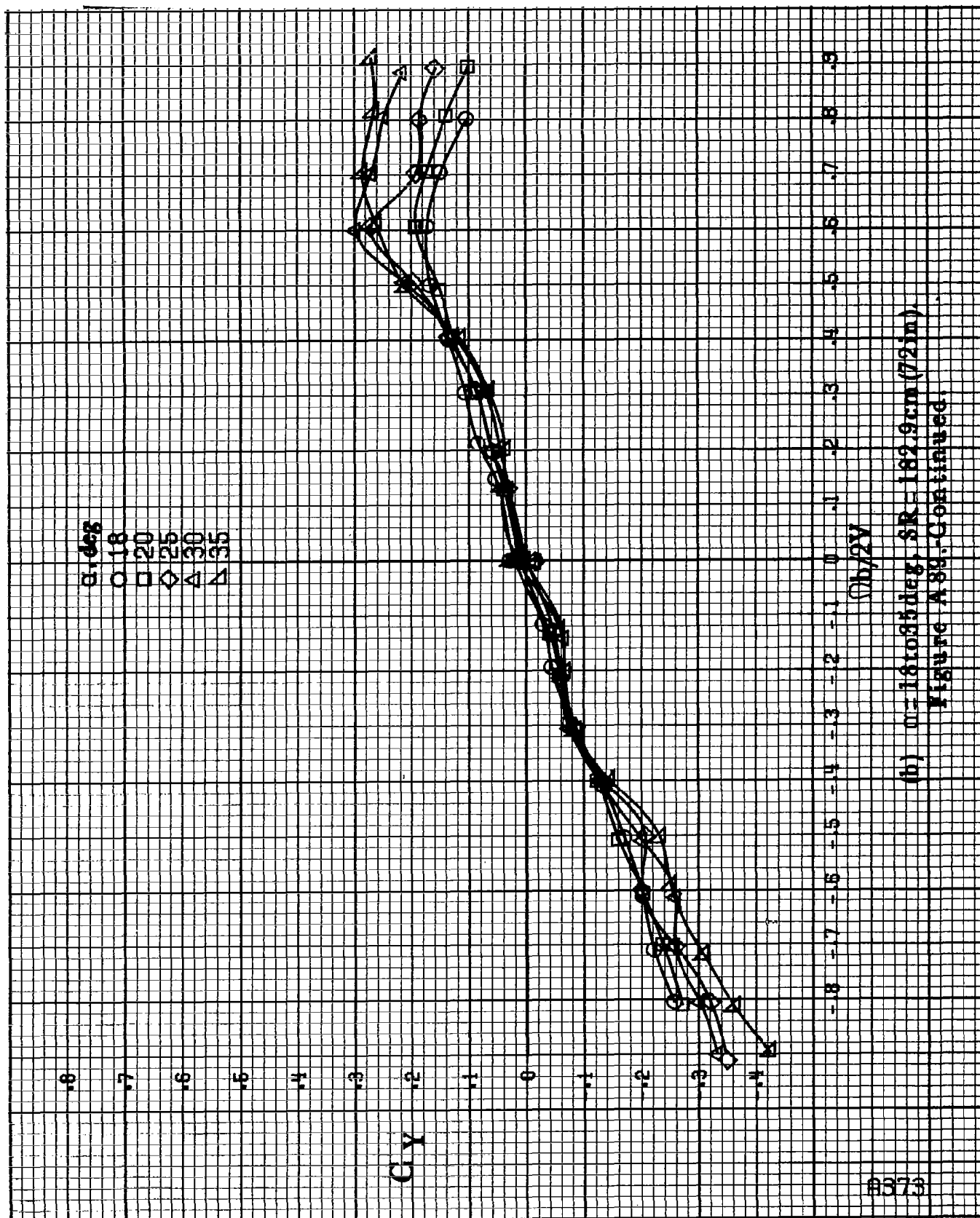


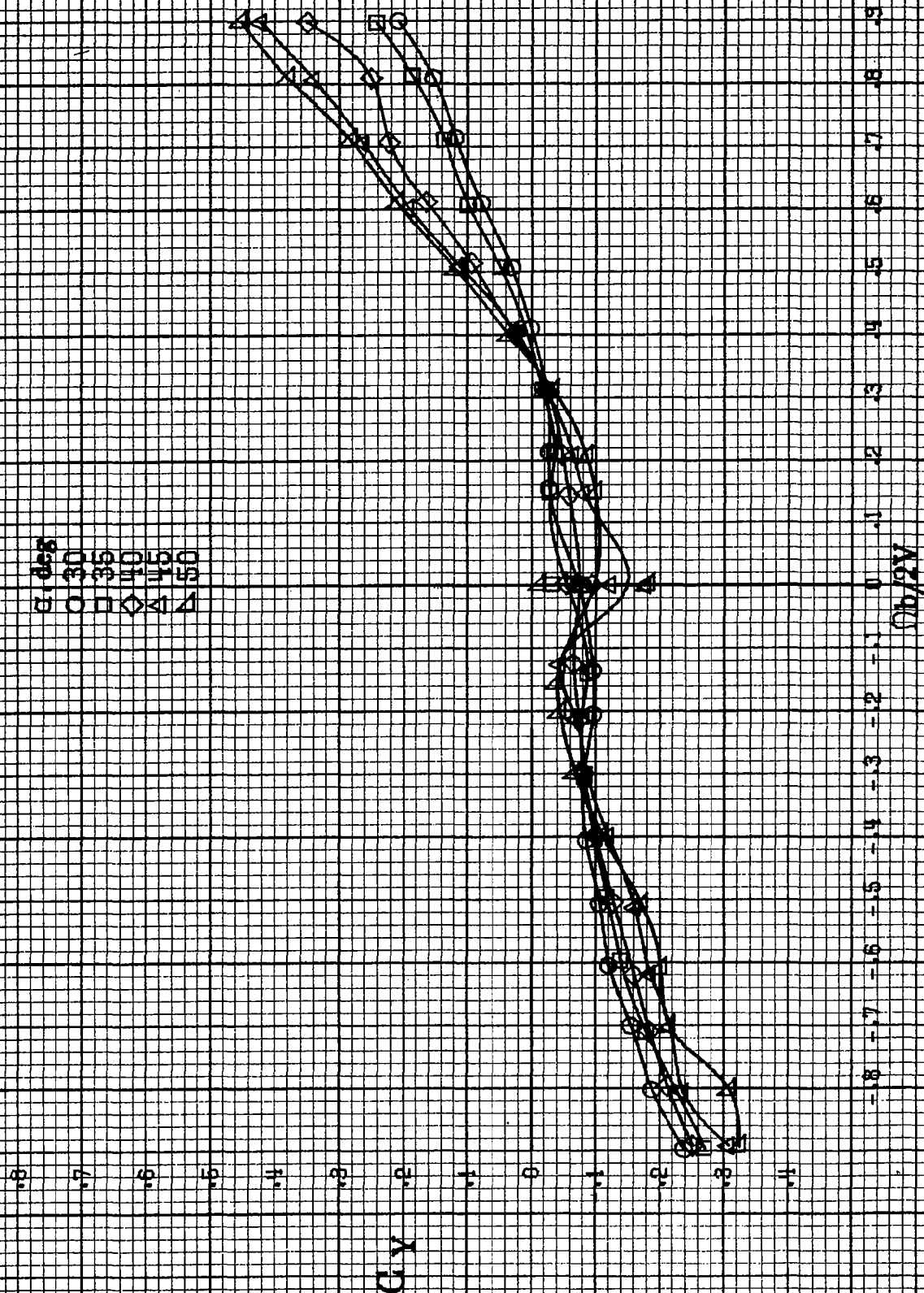
(d)  $\eta = 85$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A88-Continued.



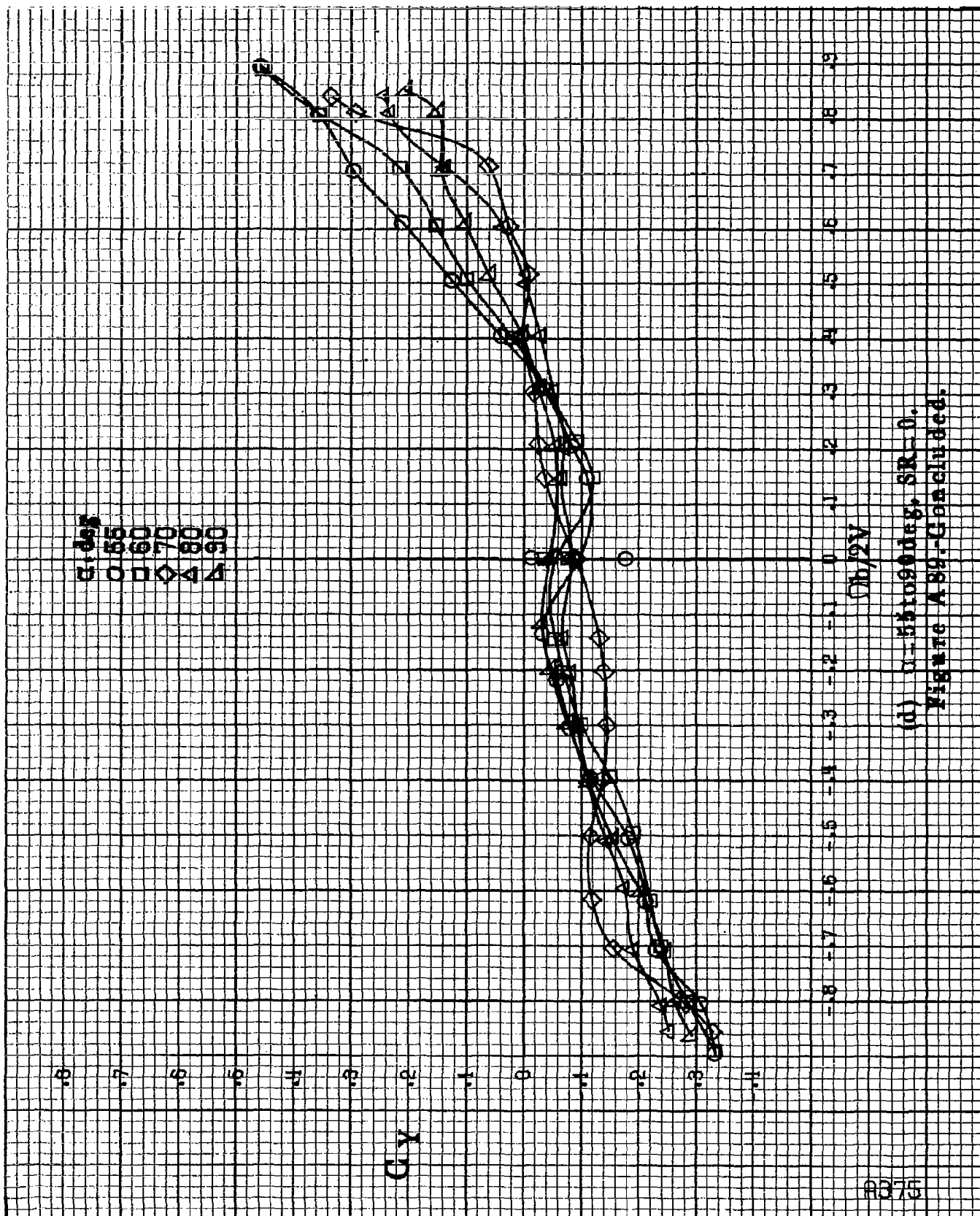
(s)  $\alpha = 84.6^\circ$ ,  $SR = 182.9 \text{ cm}$  (72 in.).







(c)  $\omega=80 \text{ to } 60 \text{ deg}$ ,  $SR=0$ .  
Figure A89.-Continued.



(d)  $\alpha=55$  to  $90$  deg,  $SR=0$ .  
Figure A89-Continued.

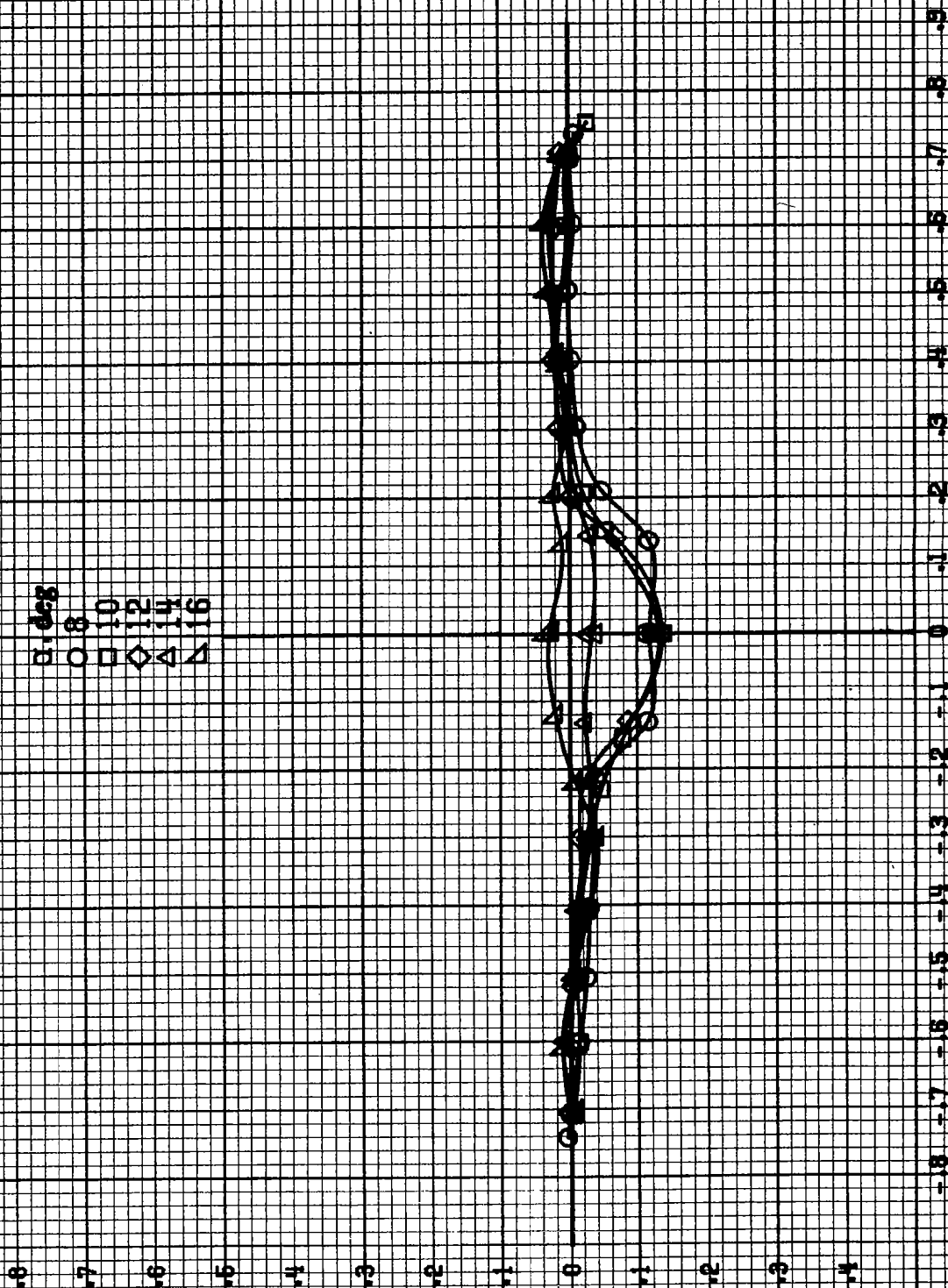
$\alpha, \text{deg}$   
 $\circ 8$   
 $\square 10$   
 $\diamond 12$   
 $\triangle 14$   
 $\nabla 16$

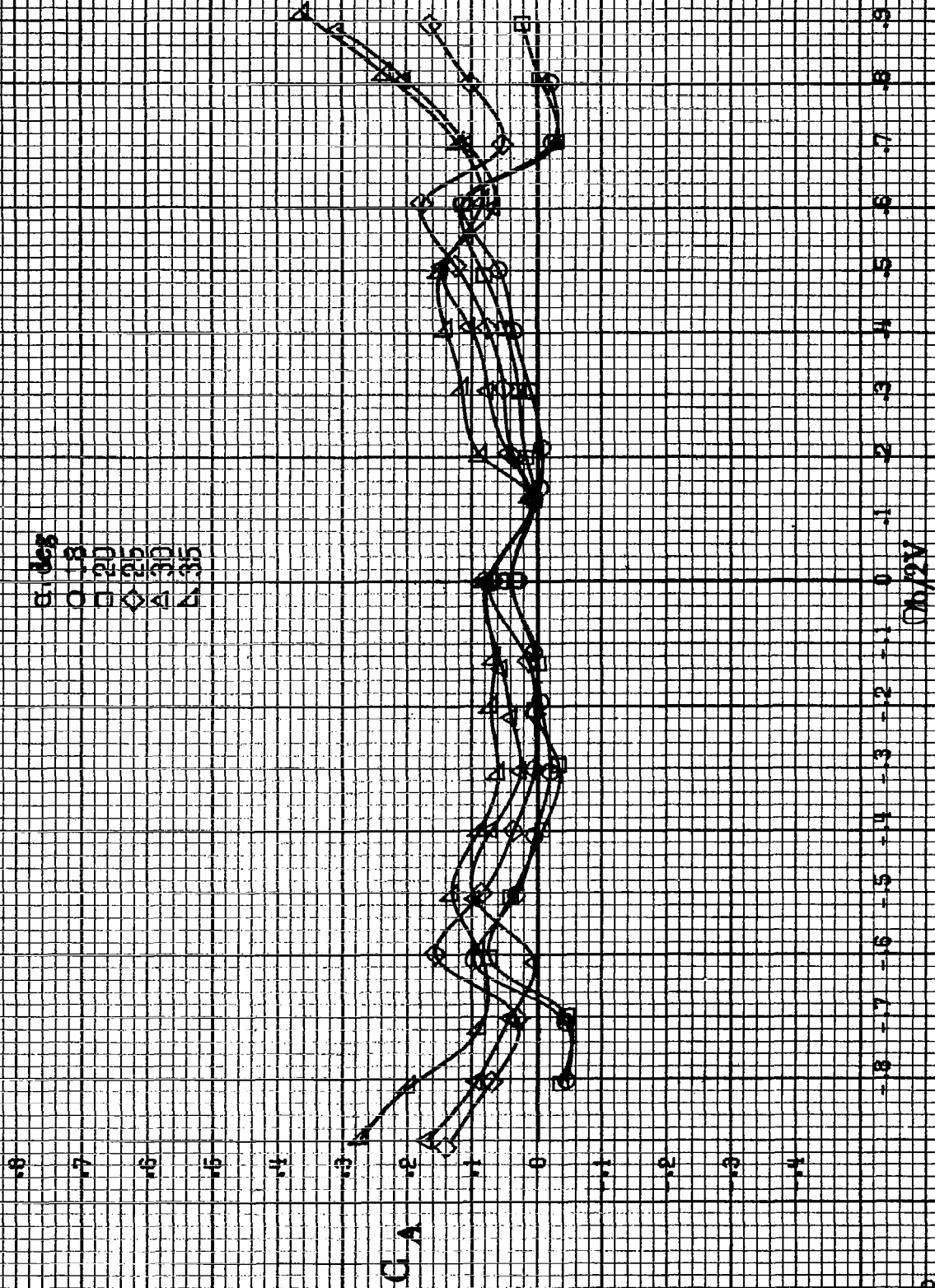
$C_A$

$\Omega b/2V$

(a)  $\alpha = 8 \text{ to } 16 \text{ deg}$ ,  $SK = 182.9 \text{ cm} (72 \text{ in})$ .

Figure A90. Effect of rotation rate and angle of attack on axial-force coefficient for horizontal tail off configuration.  $\delta_e = 0^\circ$ ,  $\delta_a = 0^\circ$ ,  $\delta_s = 0^\circ$ ,  $\beta = 0^\circ$ .





B377

(b)  $\theta = 1.8$  to  $3.5$  deg,  $SR = 182.9 \text{ cm (72 in.)}$ .  
Figure A 90.-Continued.

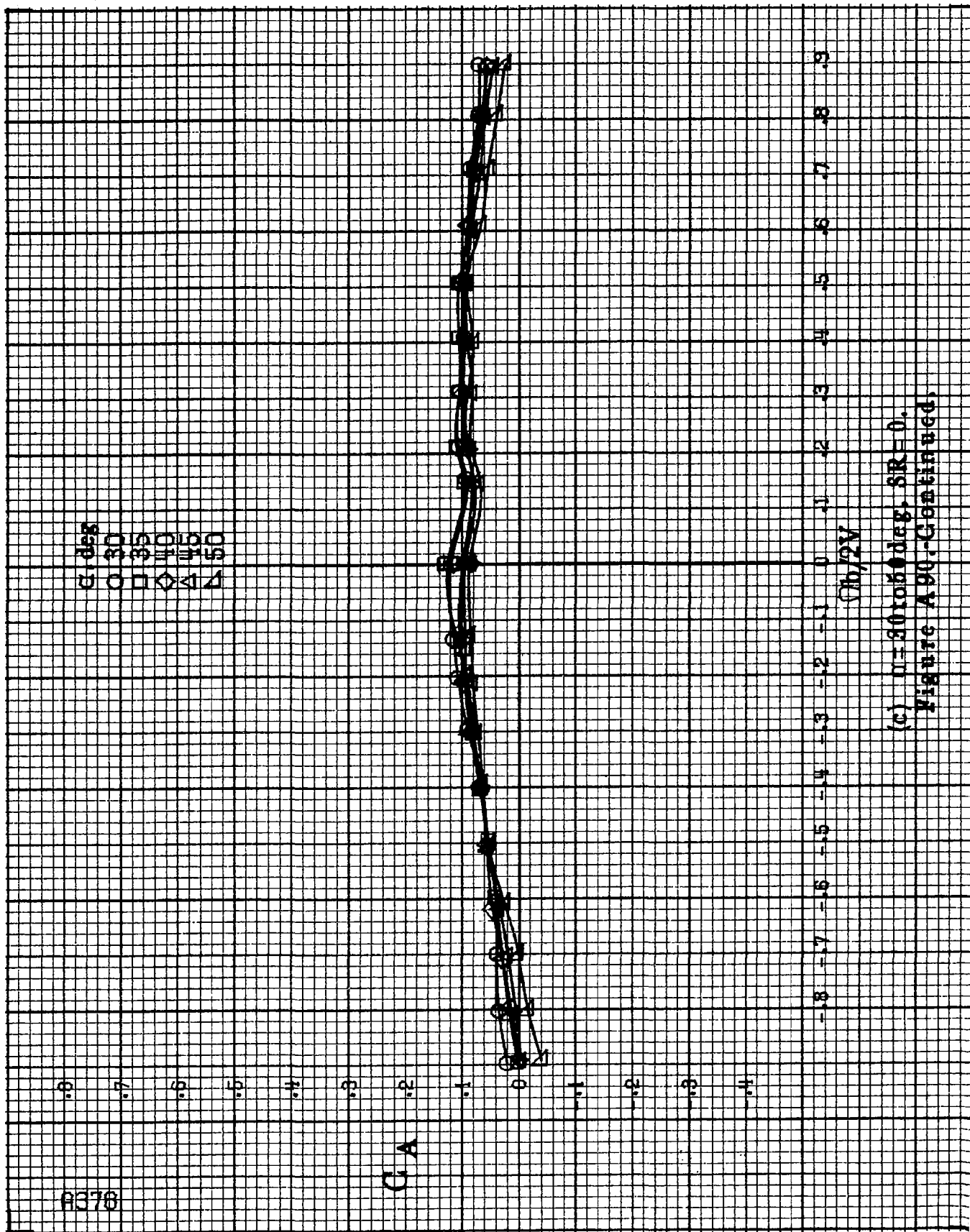
8378

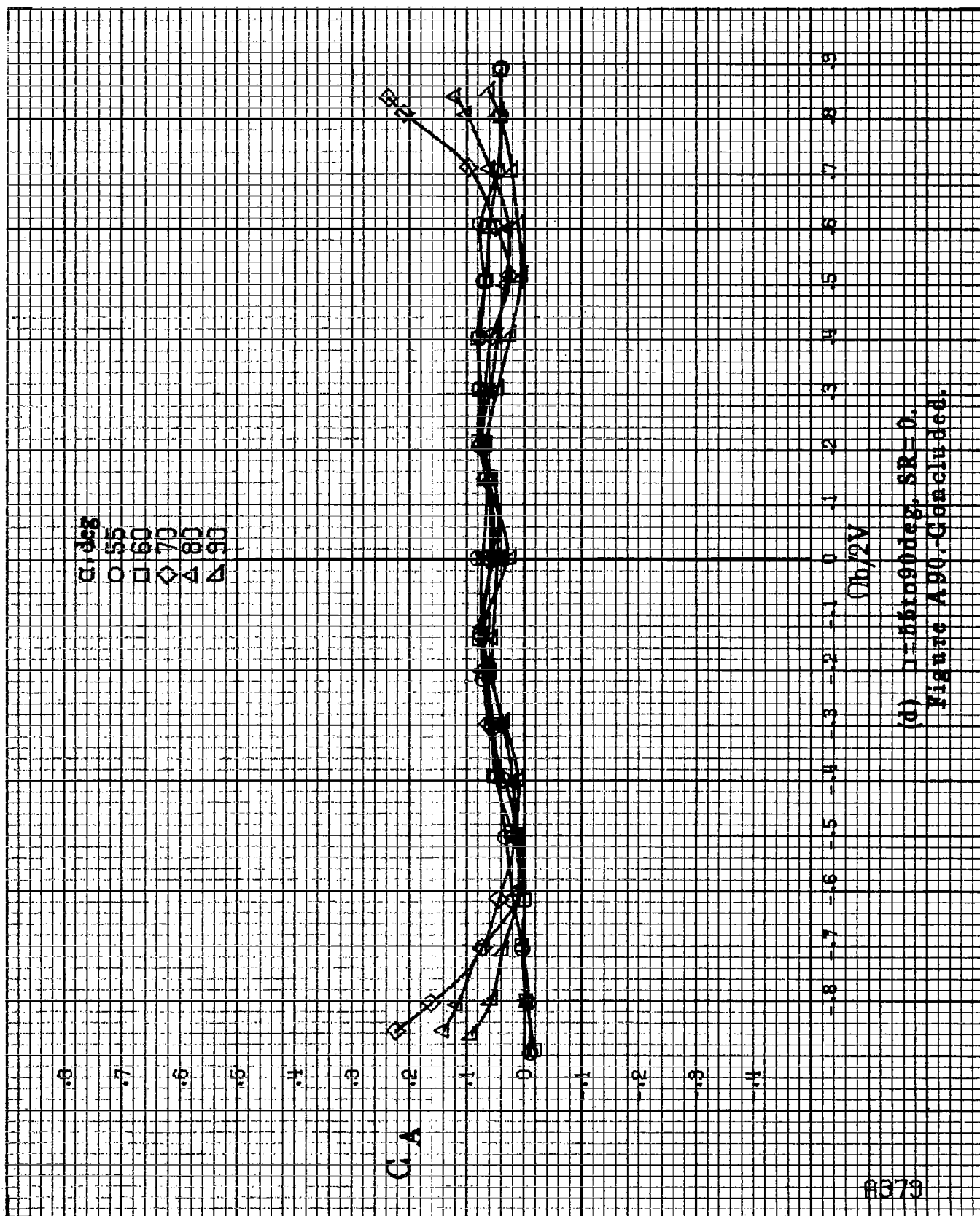
$\alpha$ , deg  
 30  
 35  
 40  
 45  
 50

G A

$\Omega b/2V$

(c)  $n=30$  to  $60$  deg,  $SR=0$ .  
 Figure A 90.-Continued.





8360

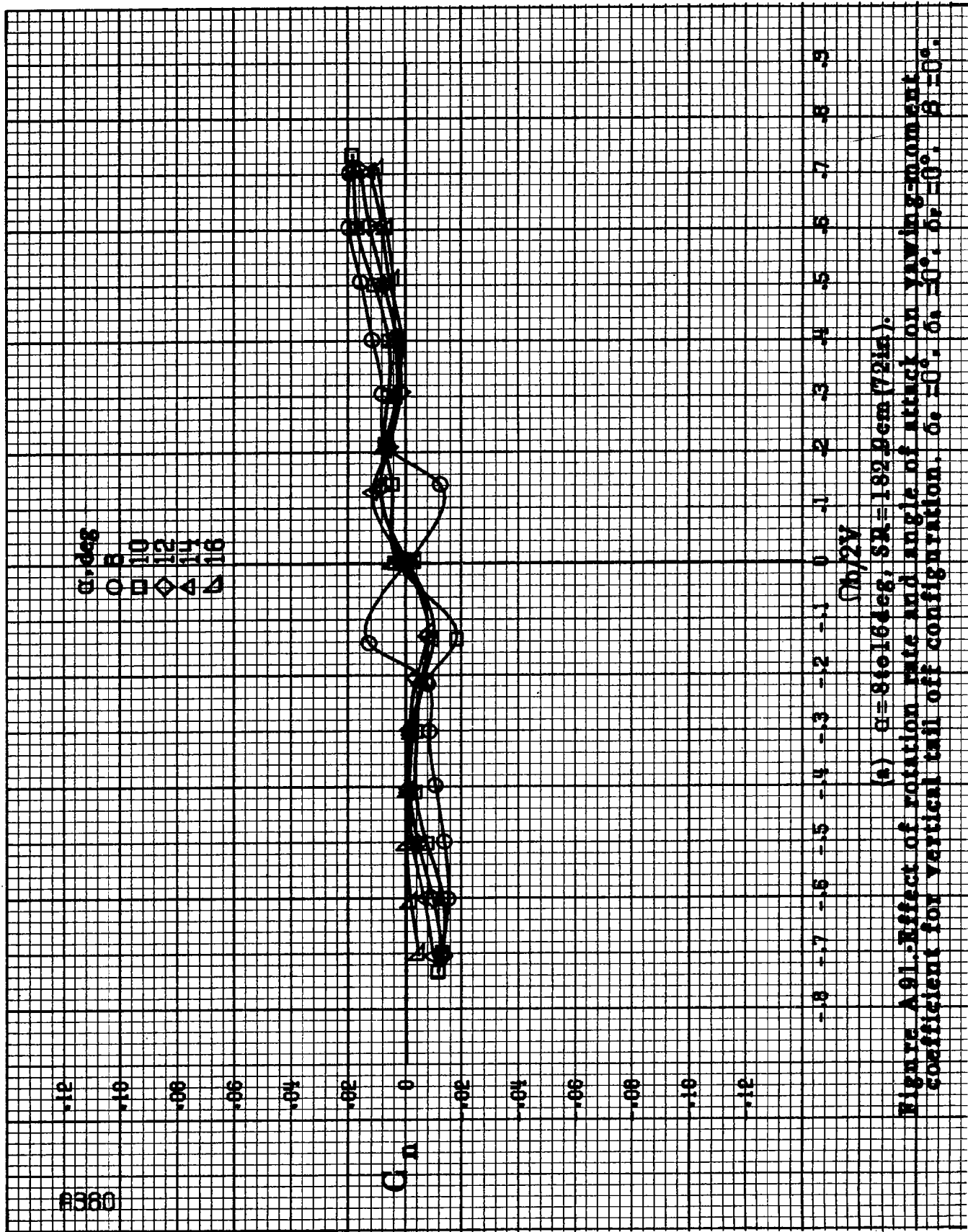
$\alpha$ , deg  
 8  
 10  
 12  
 14  
 16

$C_n$

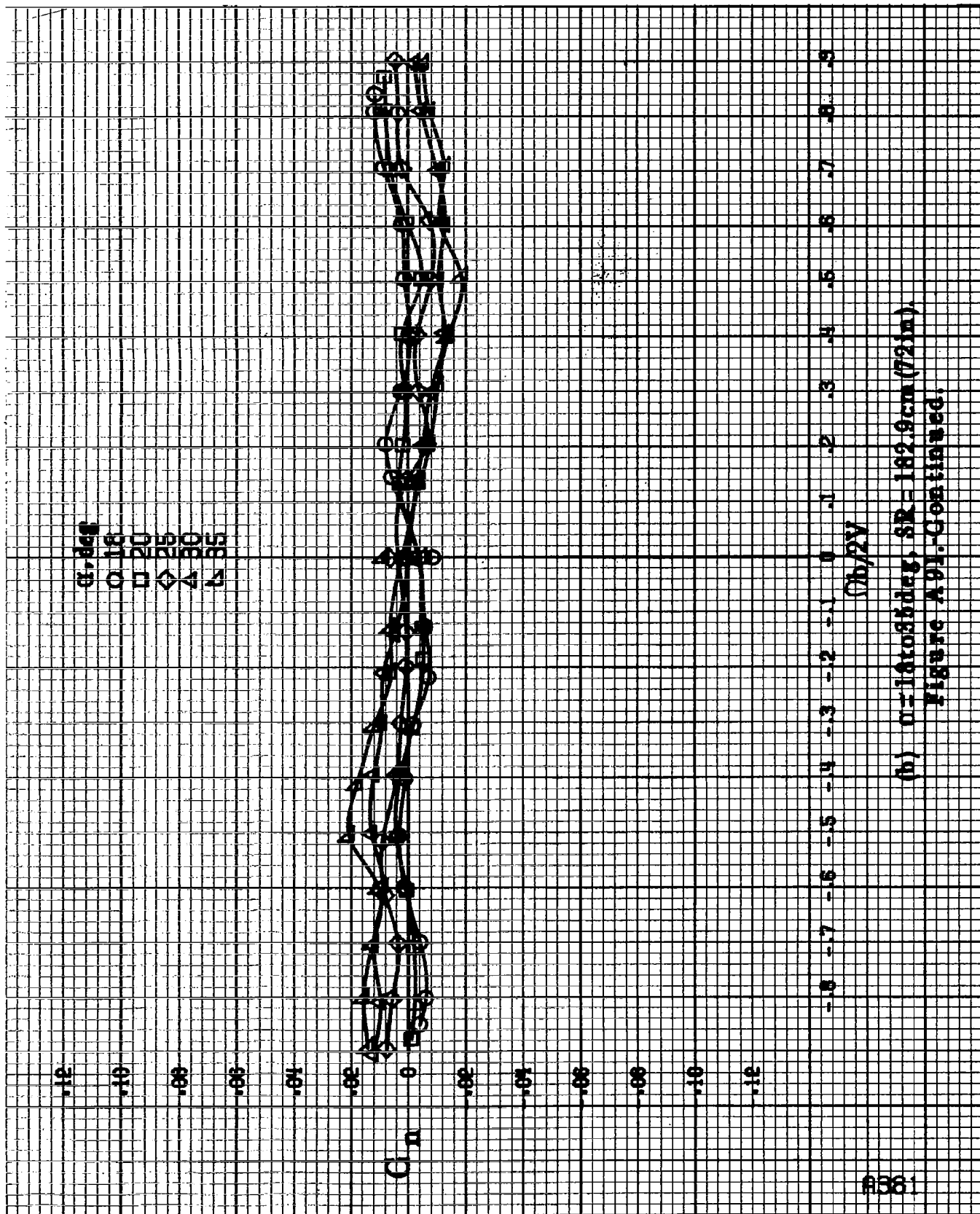
$C_{n/2V}$

(a)  $\alpha = 8$  to  $16$  deg,  $SAR = 182.9$  cm (72 in).

Figure A91. Effect of rotation rate and angle of attack on yawing-moment coefficient for vertical tail off configuration.  $\delta_1 = 0^\circ$ ,  $\delta_2 = 0^\circ$ ,  $\beta = 0^\circ$ .



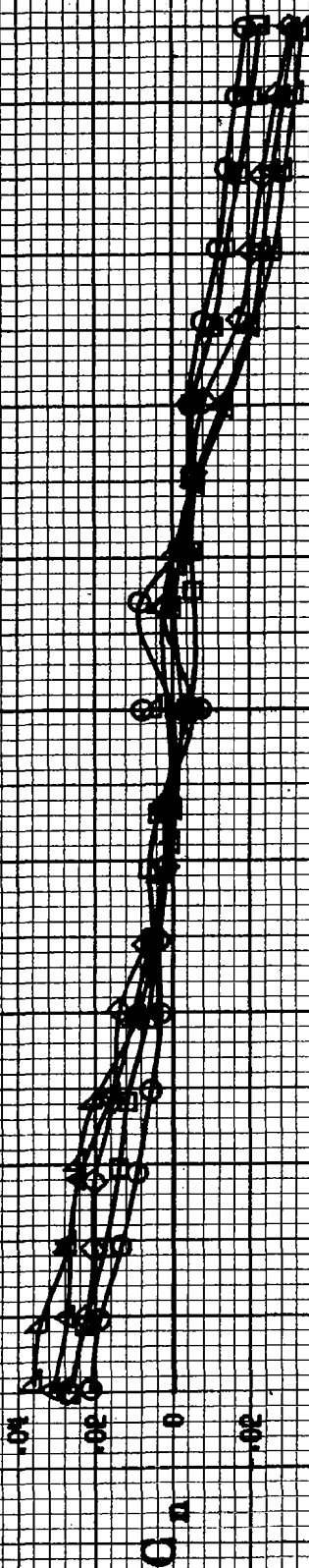




(b)  $\mu = 1.6 \times 10^{-18} \text{ sec}$ ,  $SR = 182.9 \text{ cm (72 in.)}$ .  
Figure A91. Continued.

B362

$\alpha$ , deg  
 30  
 35  
 40  
 45  
 50



$Oh/2V$

(c)  $\alpha = 80$  to  $50$  deg,  $SR = 0$ ,  
 Figure A.91.-Continued.

$\alpha$ , deg  
 ○ 55  
 □ 60  
 ◇ 70  
 △ 80  
 ▴ 90

.12

.10

.08

.06

.04

.02

0

-.02

-.04

-.06

-.08

-.10

-.12

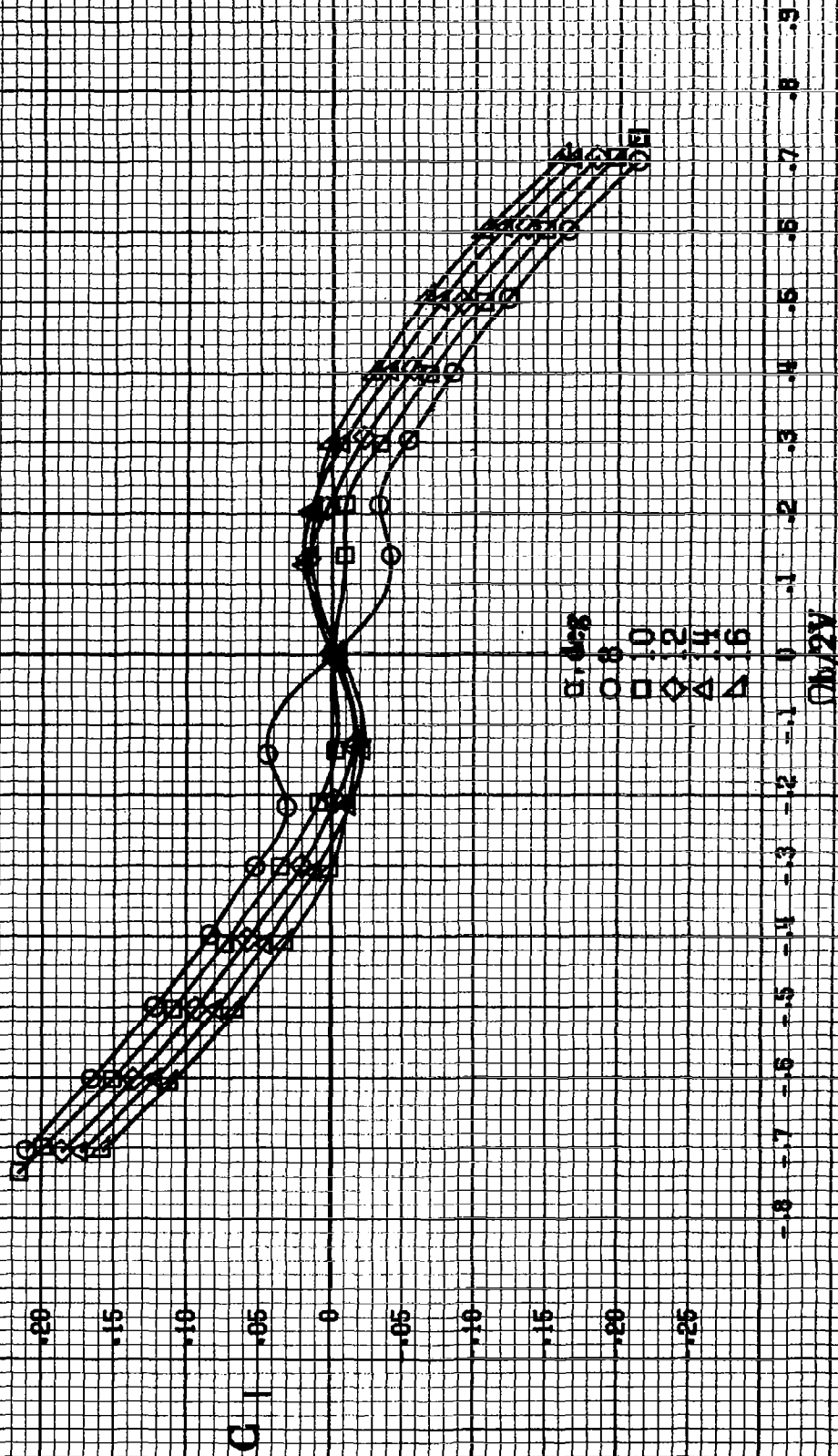
$C_n$

-1.8 -1.7 -1.6 -1.5 -1.4 -1.3 -1.2 -1.1 0 .1 .2 .3 .4 .5 .6 .7 .8 .9

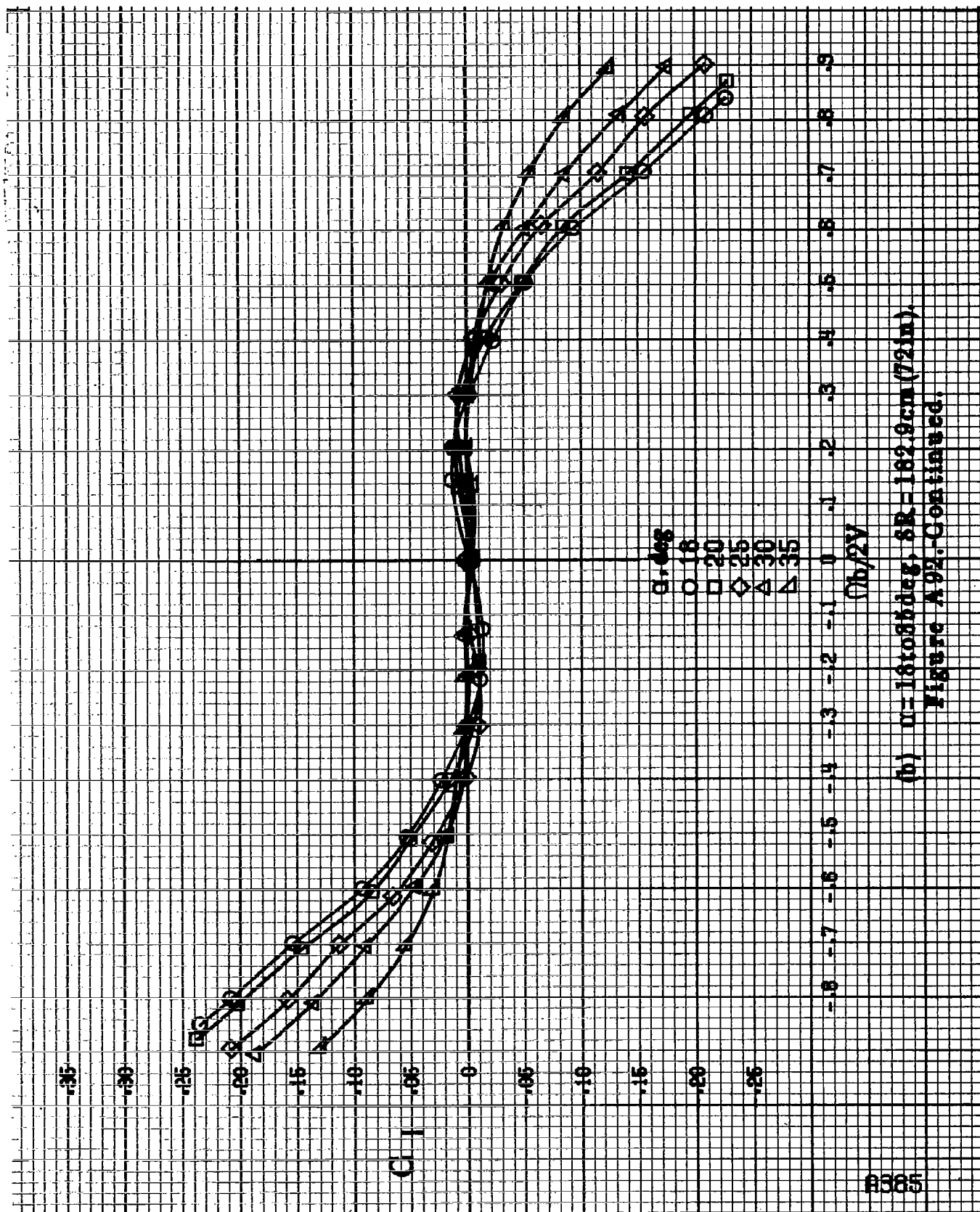
$\Omega b/2V$

(d)  $\alpha=85$  to  $90$  deg,  $SR=0$ .  
 Figure A91.-Concluded.

A363



(a)  $\alpha = 84.016 \text{ deg}$ ,  $S_R = 192.9 \text{ cm}^2$  (7216).  
 Figure A92. Effect of rotation rate and angle of attack on rolling moment coefficient for vertical tail off configuration,  $\delta_a = 0^\circ$ ,  $\delta_v = 0^\circ$ ,  $\beta = 0^\circ$ .



(b)  $n = 1.61085$  deg,  $SR = 182.9$  cm (72 in).  
Figure A 92. Continued.

A386

.35

.30

.25

.20

.15

.10

.05

0

-.05

-.10

-.15

-.20

-.25

$\alpha$

$\alpha, \text{deg}$

○ 30

□ 35

◇ 40

△ 45

▽ 50

$\Omega b/2V$

-.8

-.7

-.6

-.5

-.4

-.3

-.2

-.1

0

.1

.2

.3

.4

.5

.6

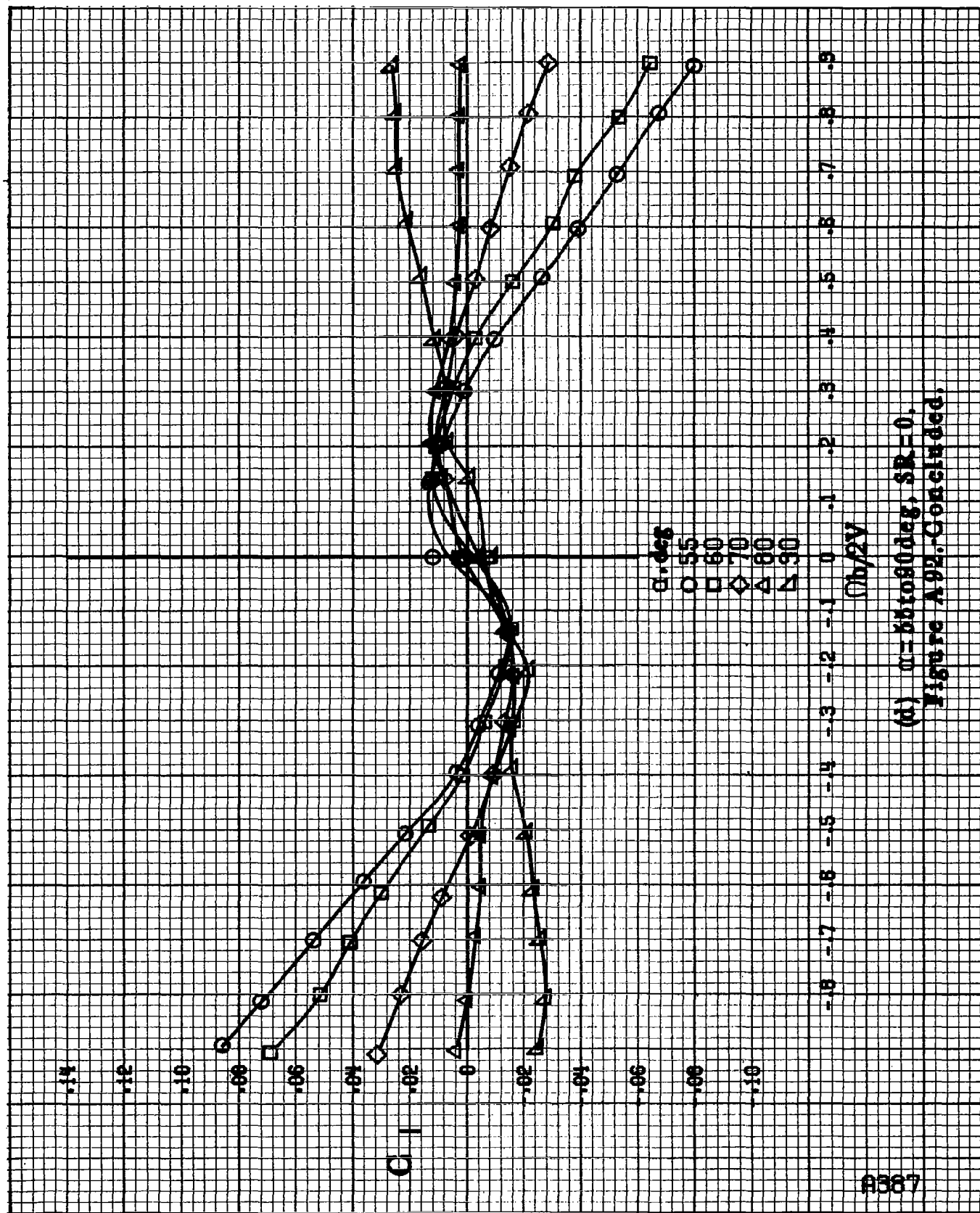
.7

.8

.9

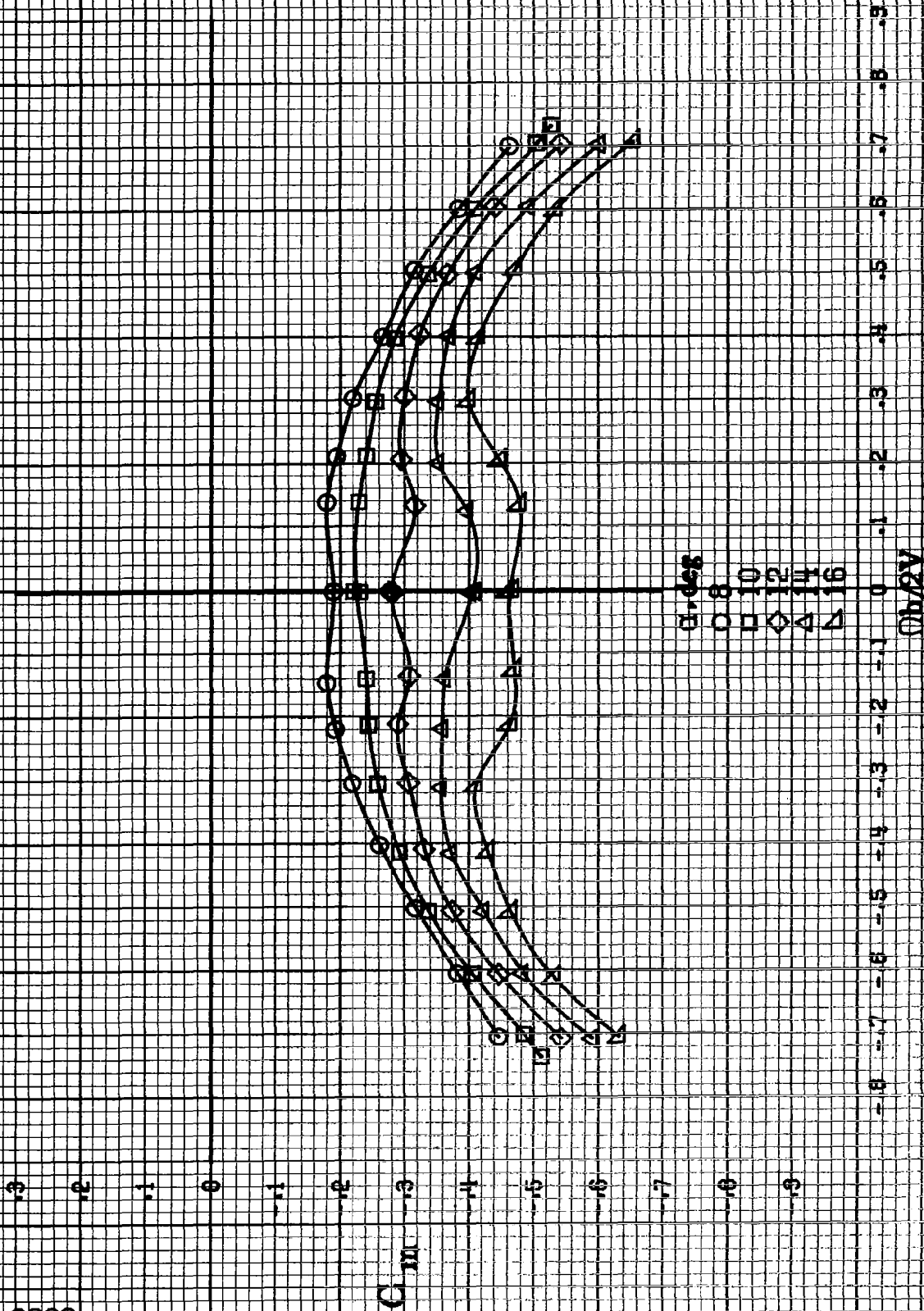
(c)  $\alpha = 30$  to  $50$  deg,  $SR = 0$ .

Figure A92.-Continued.



(d)  $\alpha = 80$  to  $90$  deg,  $SR = 0$ .  
Figure A.92.-Concluded.

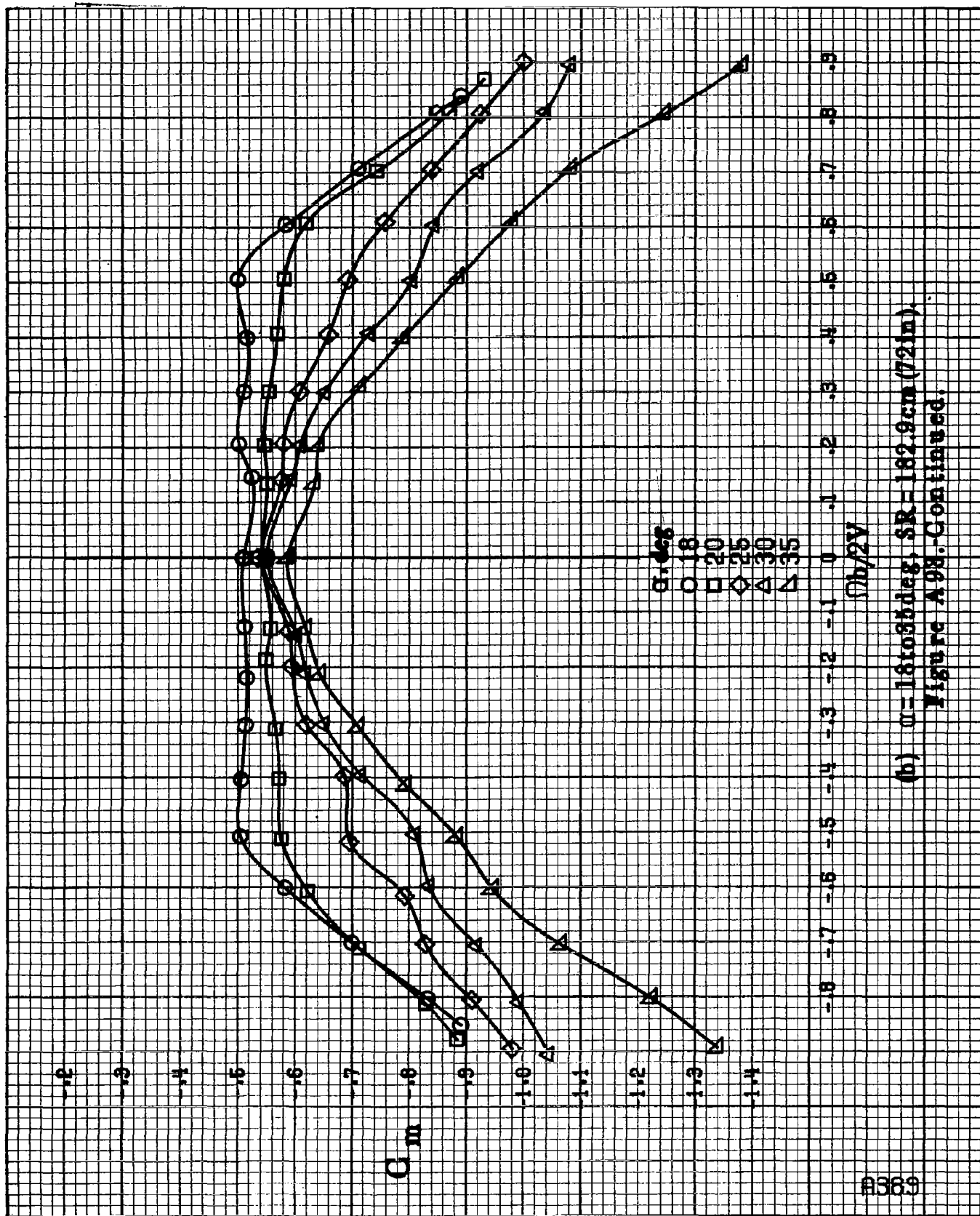
B388



(a)  $\alpha = 8$  to  $16$  deg,  $SR = 182.9$  cm (72 in).

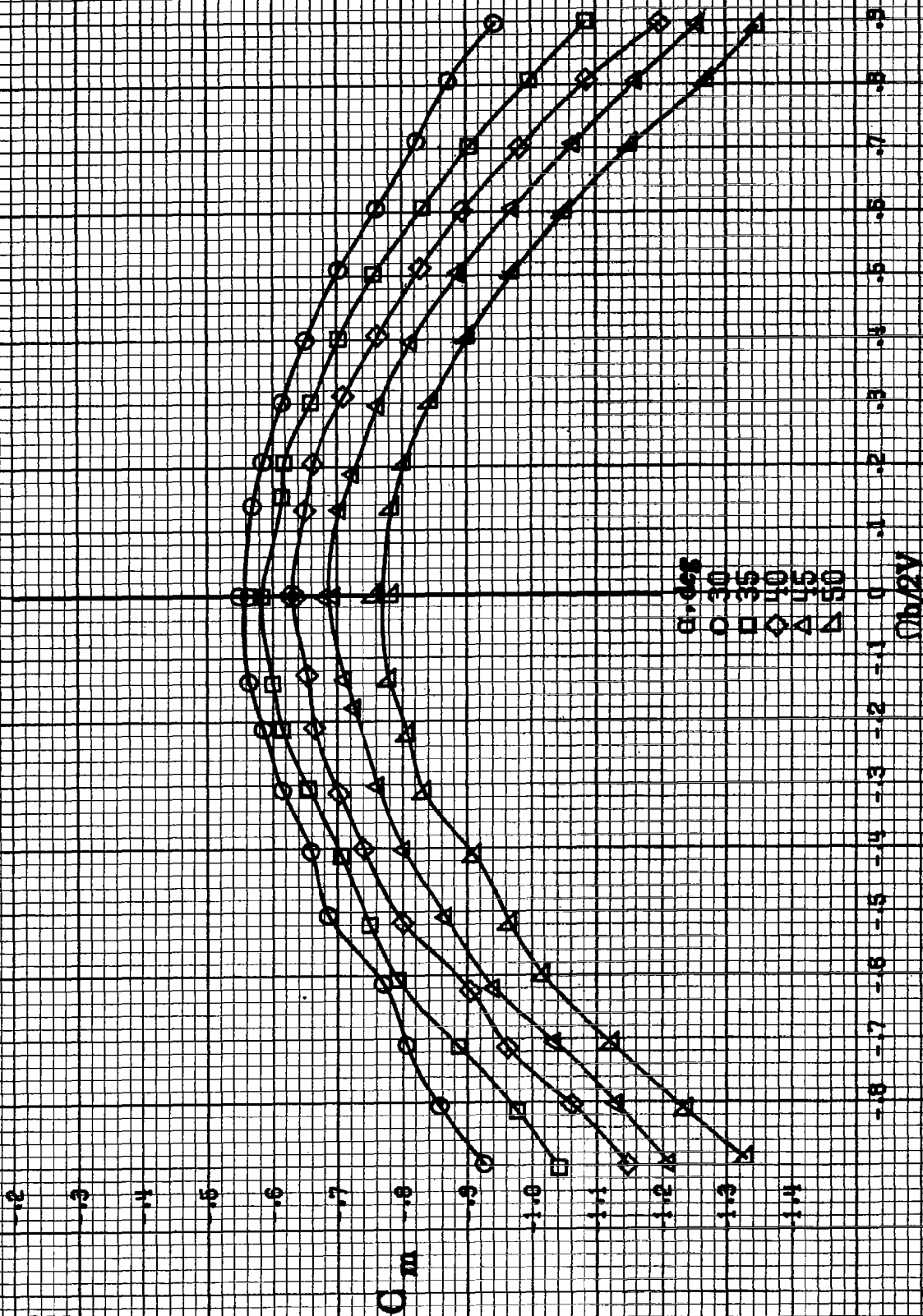
Figure A93. Effect of rotation rate and angle of attack on pitching-moment coefficient for vertical tail off configuration.  $\delta_1 = 5^\circ$ ,  $\delta_2 = 0^\circ$ ,  $\beta = 0^\circ$ .



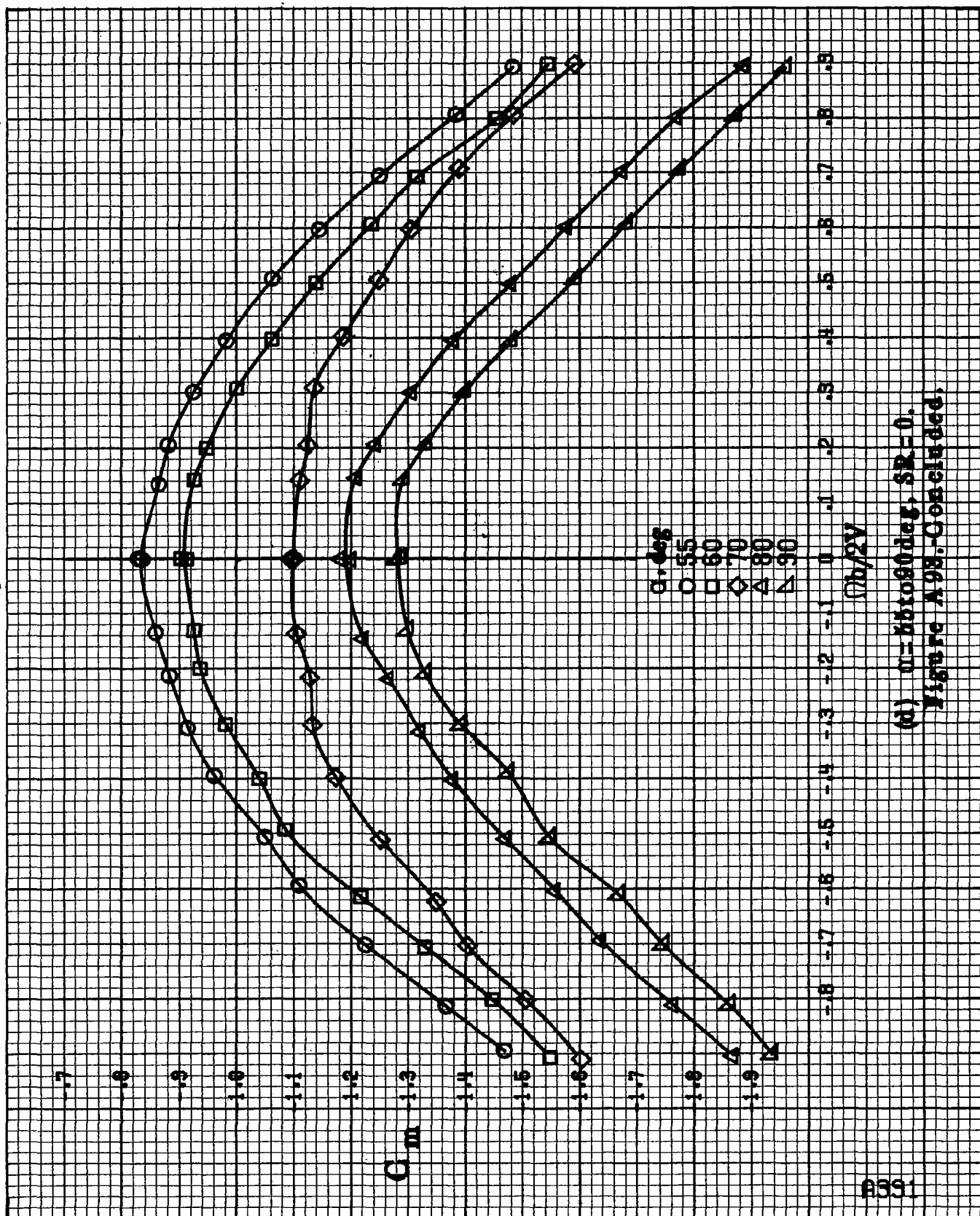


(b)  $\alpha = 18$  to  $35^\circ$ ,  $SR = 182.9 \text{ cm (72 in.)}$ .  
Figure A98-Continued.

#390

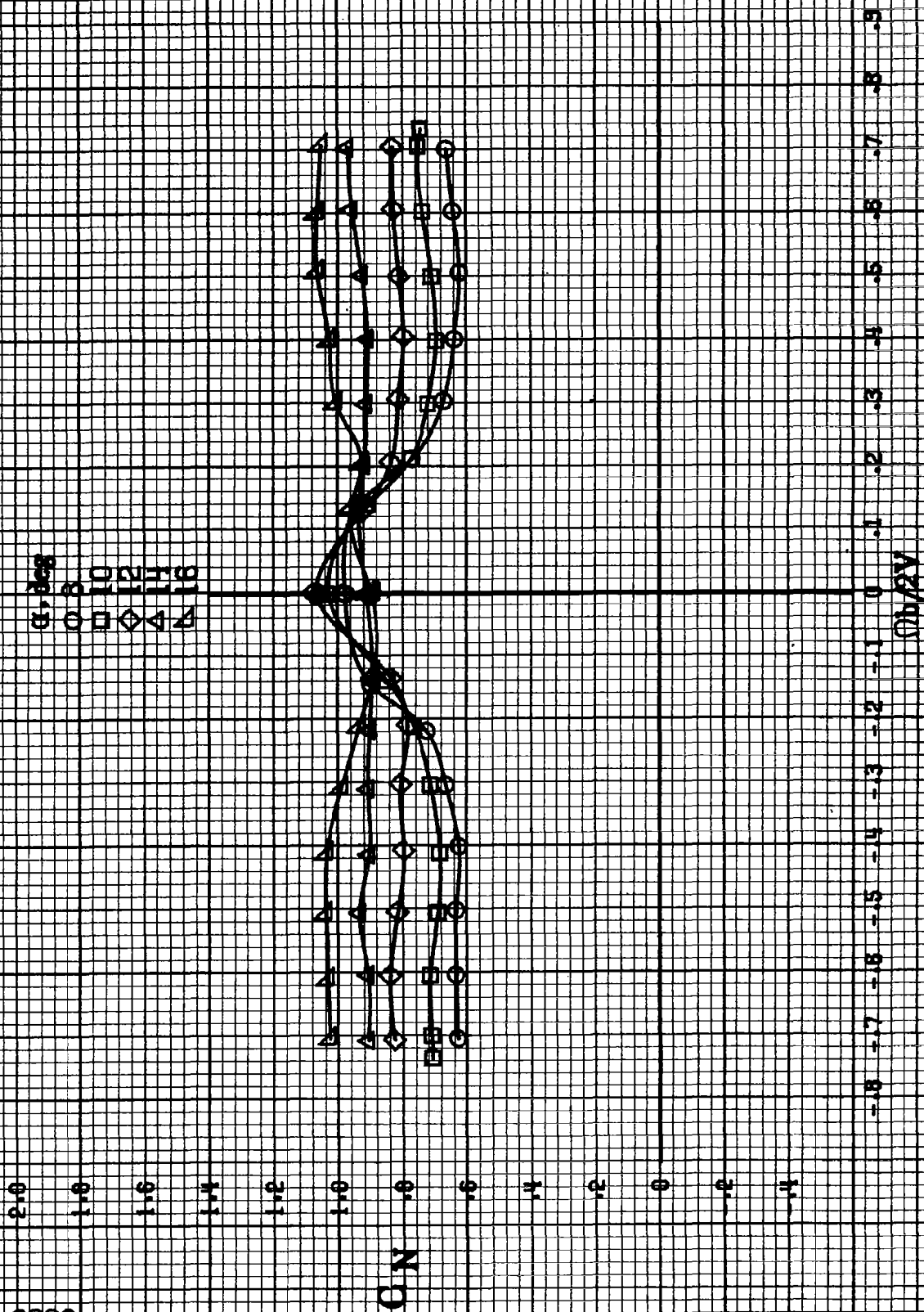


(c)  $\alpha = 80$  to  $50$  deg,  $SR = 0$ .  
Figure A9B-Continued.



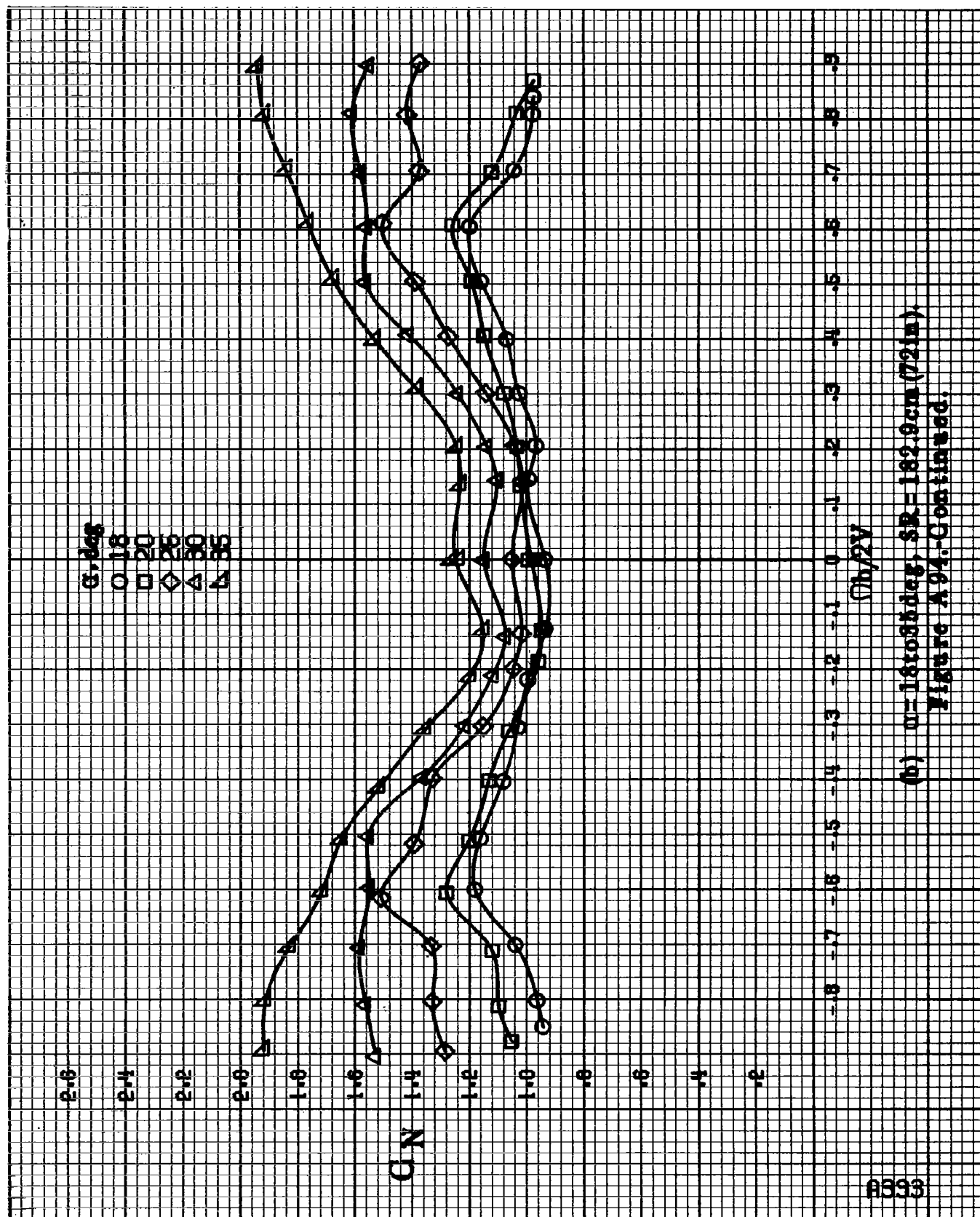
(d)  $\alpha = 55$  to  $90$  deg,  $SR = 0$ .  
Figure A98. Concluded.

8392

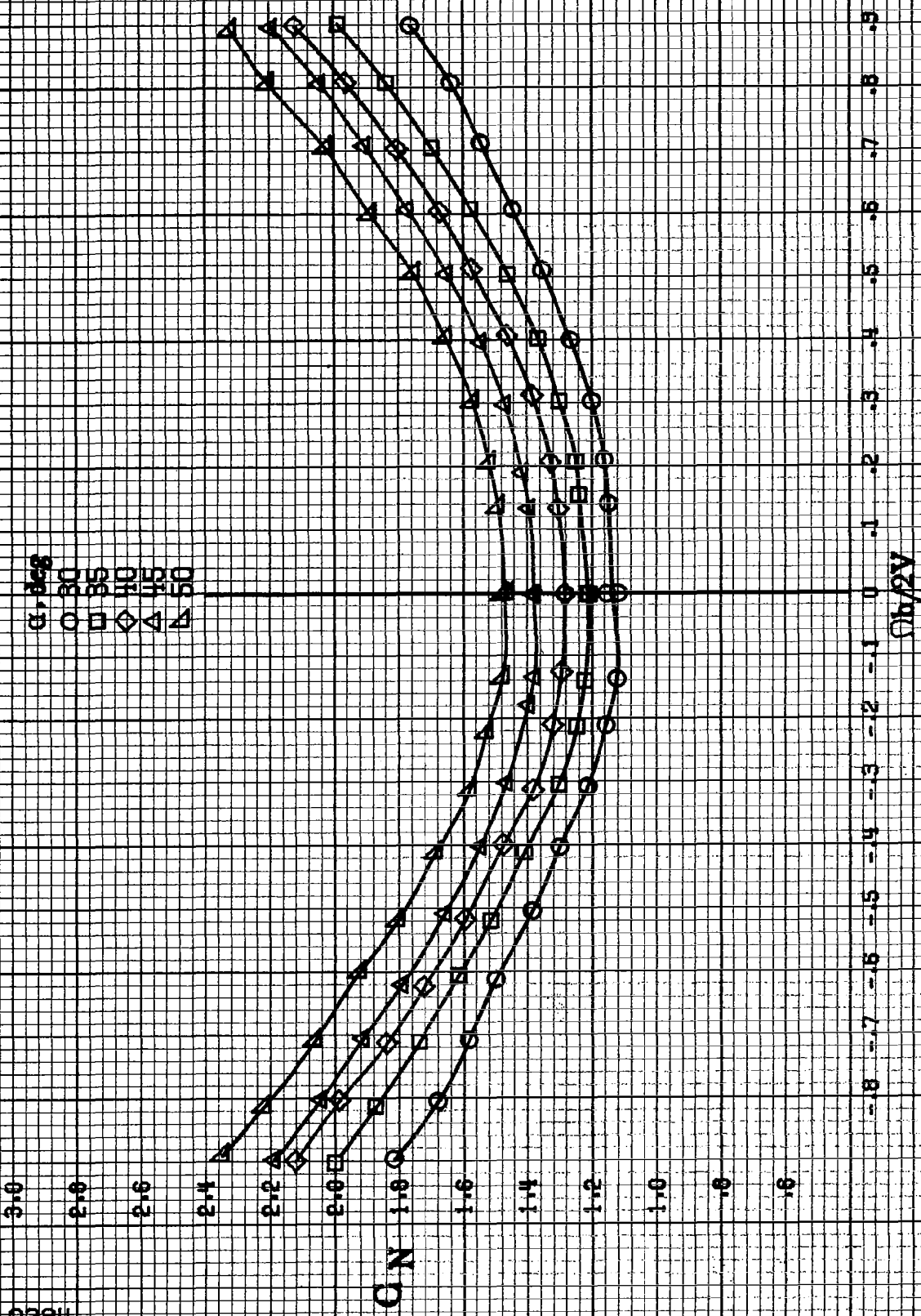


(a)  $\alpha = 8$  to  $16$  deg,  $SR = 182$ ,  $\beta_{crit} = 72$  in.

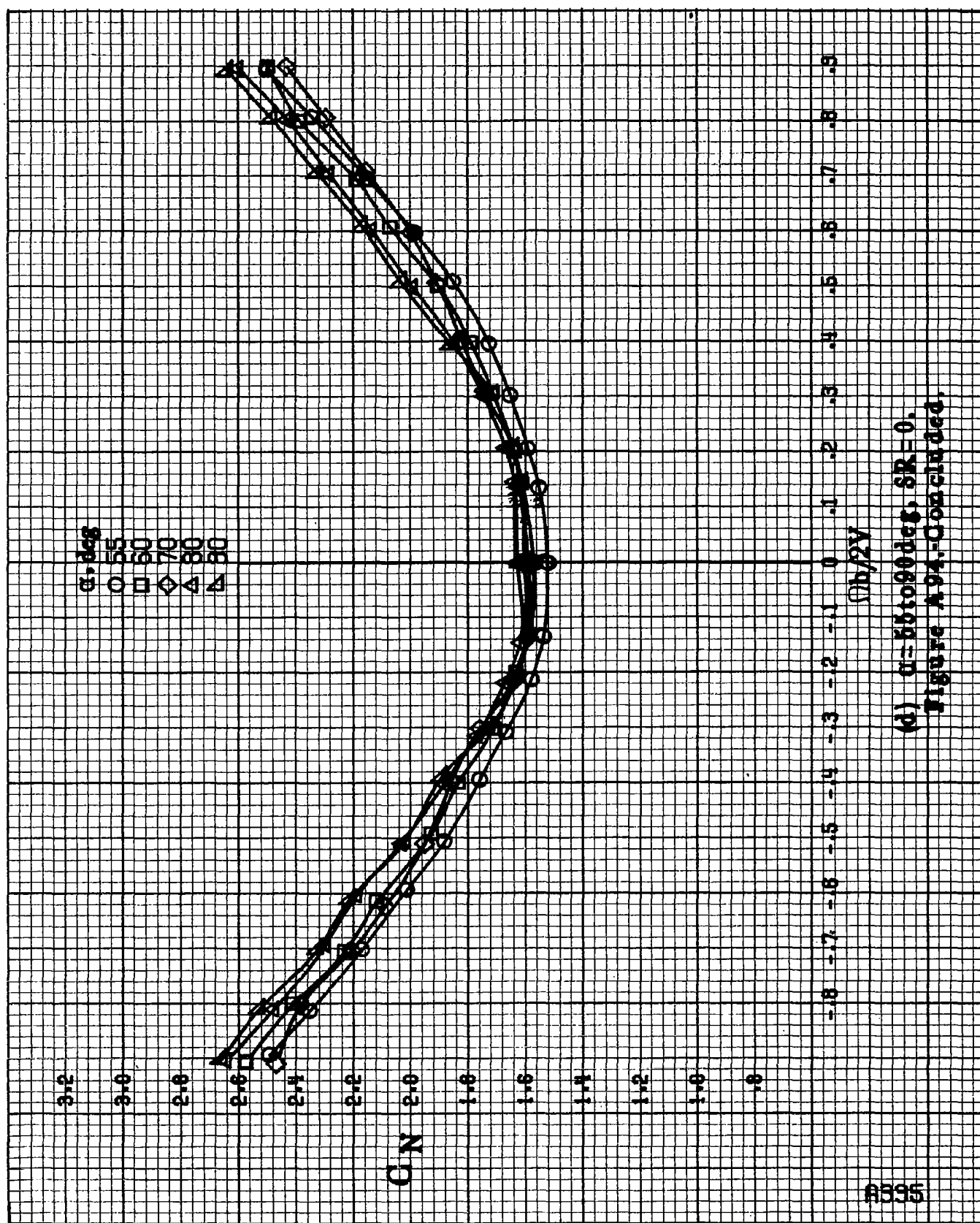
Figure A94: Effect of rotation rate and angle of attack on normal force coefficient for vertical tail off configuration.  $\delta_a = 10^\circ$ ,  $\delta_v = 10^\circ$ ,  $\beta = 10^\circ$ .



(b)  $\alpha=18$  to  $35$  deg,  $SR=182.9$  cm (72 in).  
Figure A94.-Continued.



(c)  $\alpha=30$  to  $50$  deg,  $SR=0$ .  
Figure A94-Continued.



(d)  $\alpha = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A94-Continued.

8336

$\alpha, \text{deg}$   
 8  
 10  
 12  
 14  
 16

$C_Y$

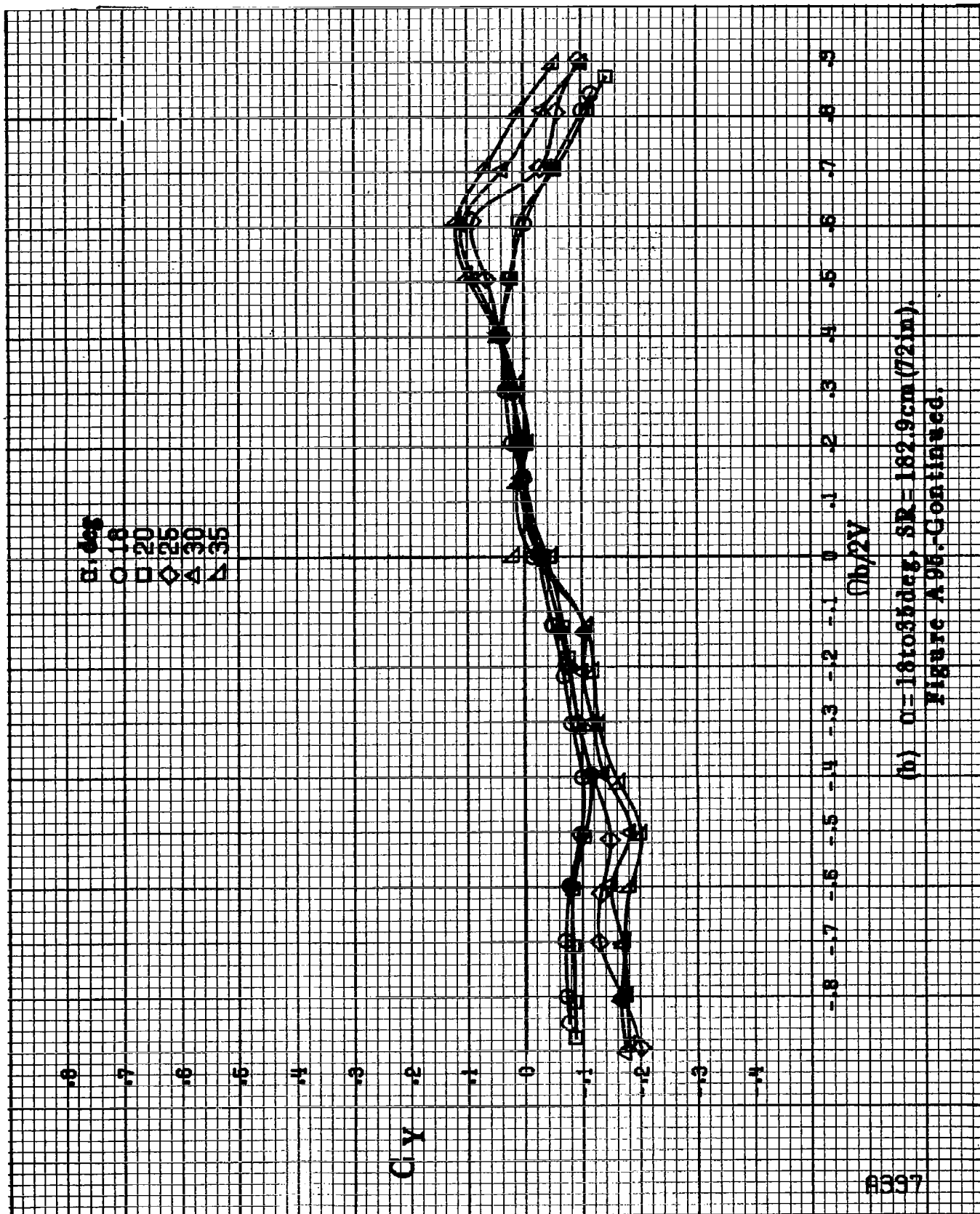


$\delta, \text{deg}$

(a)  $\alpha = 8$  to  $16 \text{ deg}$ ,  $S_R = 182.9 \text{ cm}^2$  (72 in $^2$ ).

Figure A9b. Effect of rotation rate and angle of attack on side force coefficient for vertical tail off configuration.  $\delta = 8^\circ$ ,  $10^\circ$ ,  $12^\circ$ ,  $14^\circ$ ,  $16^\circ$ .  $\beta = 0^\circ$ .





(b)  $\alpha = 18$  to  $35$  deg, SR = 182.9 cm (72 in).  
Figure A96-Continued.

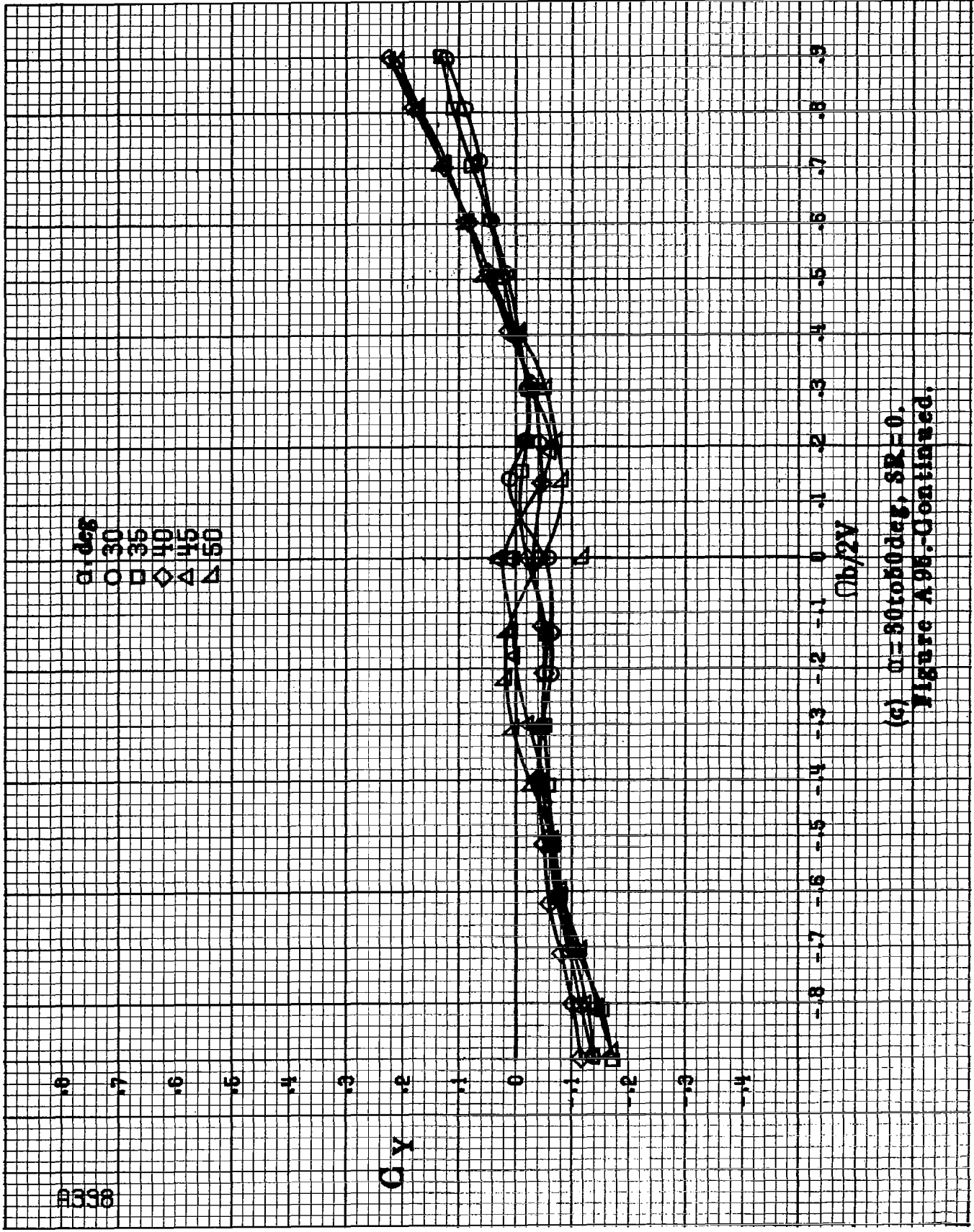
8338

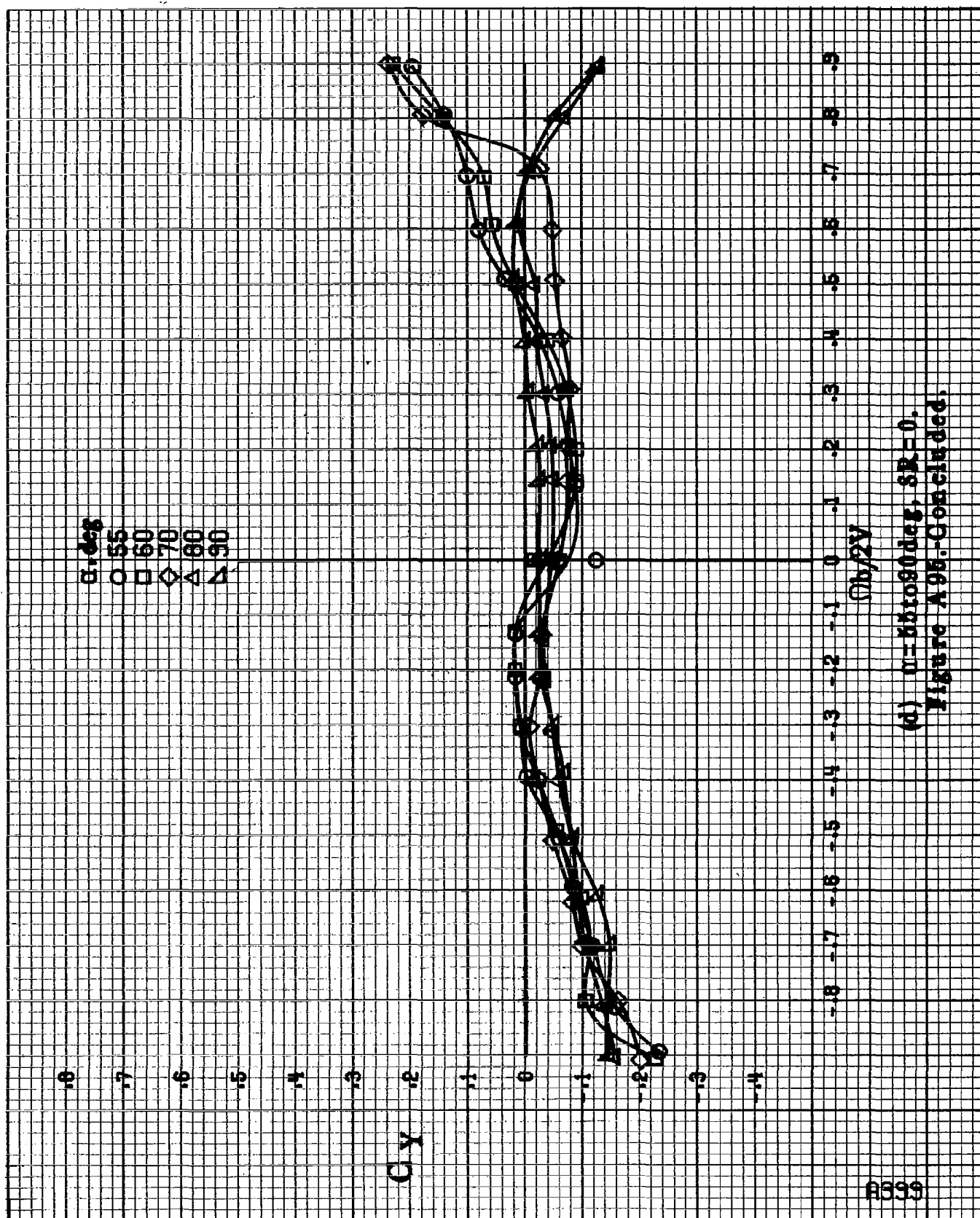
$\alpha$ , deg  
 O 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▽ 50

$\alpha_Y$

$\eta_b/2V$

(c)  $\alpha = 30$  to  $50$  deg,  $SR = 0$ .  
 Figure A 98.-Continued.



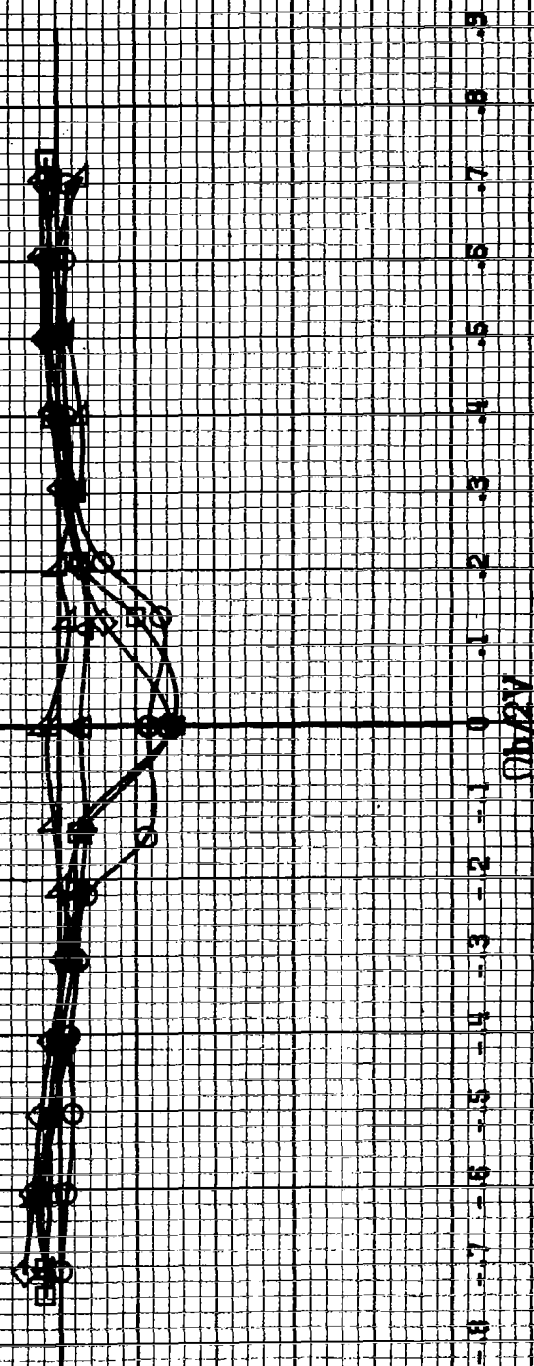


(d)  $n=66$  to  $90$  deg,  $SR=0$ .  
Figure A95-Continued.

AV00

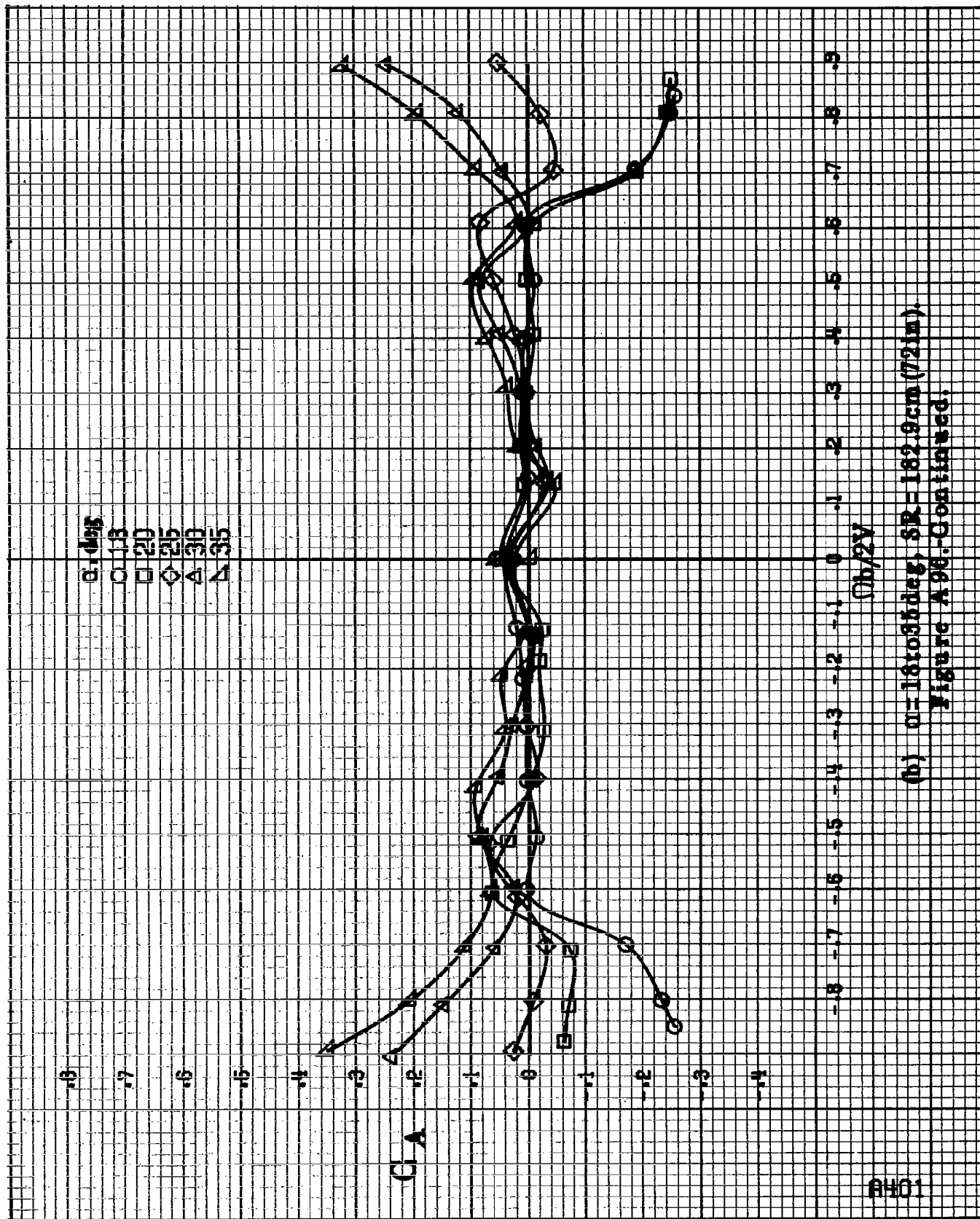
$\alpha, \text{deg}$   
 $\circ 8$   
 $\square 10$   
 $\diamond 12$   
 $\triangle 14$   
 $\nabla 16$

CA



(a)  $\alpha = 8$  to  $18^\circ$ ,  $SR = 182.9 \text{ cm (72 in.)}$ .

Figure A98. Effect of rotation rate and angle of attack on axial force coefficient for vertical tail off configuration.  $\delta_1 = 0^\circ$ ,  $\delta_2 = 0^\circ$ ,  $\delta_3 = 0^\circ$ .



(b)  $\alpha = 18$  to  $35^\circ$ ,  $SR = 162.9 \text{ cm (72 in)}$ .  
Figure A96-Continued.

201H

.6

.7

.6

.5

.4

.3

.2

.1

0

-.1

-.2

-.3

-.4

CA

$\alpha, \text{deg}$

○ 30

□ 35

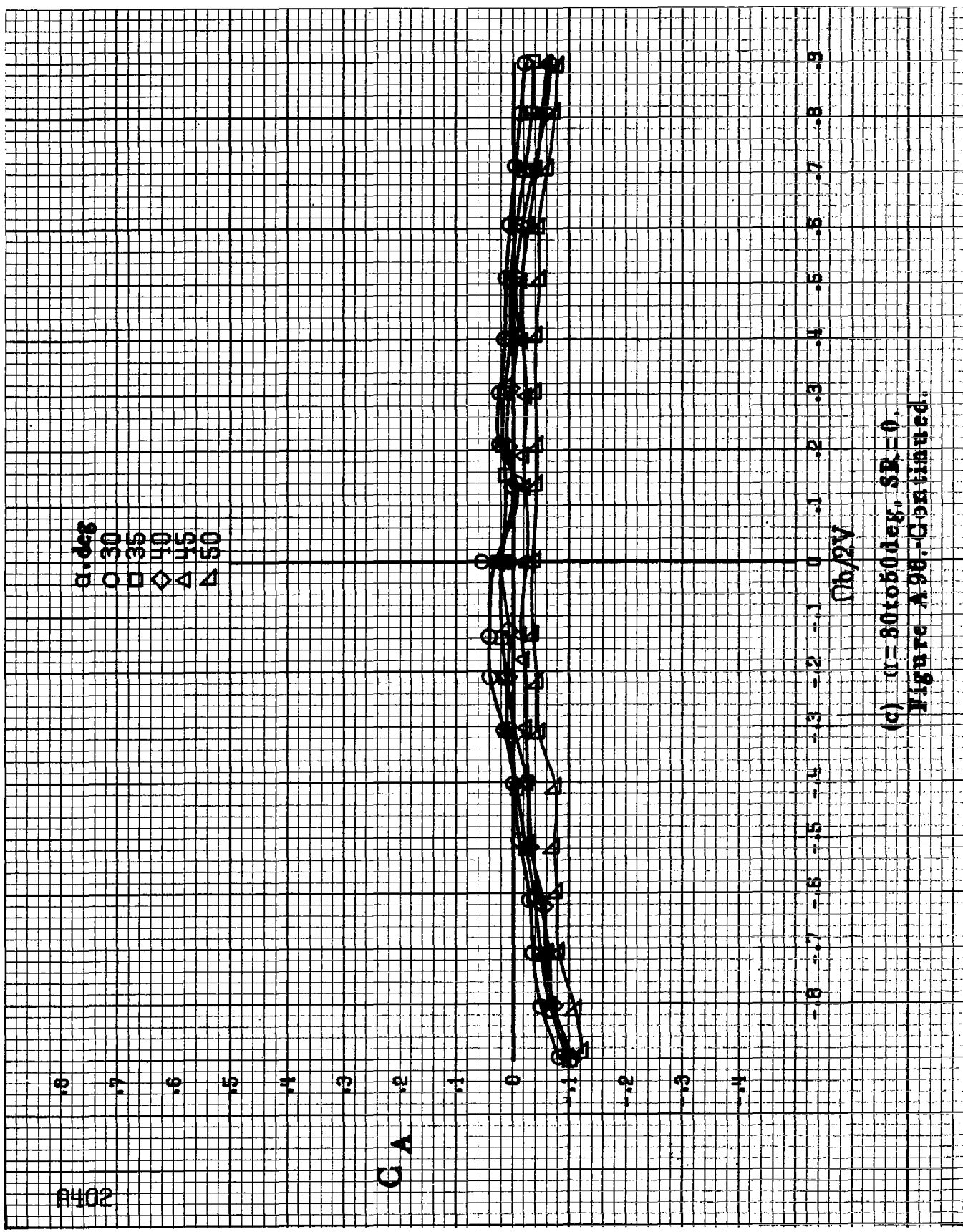
◇ 40

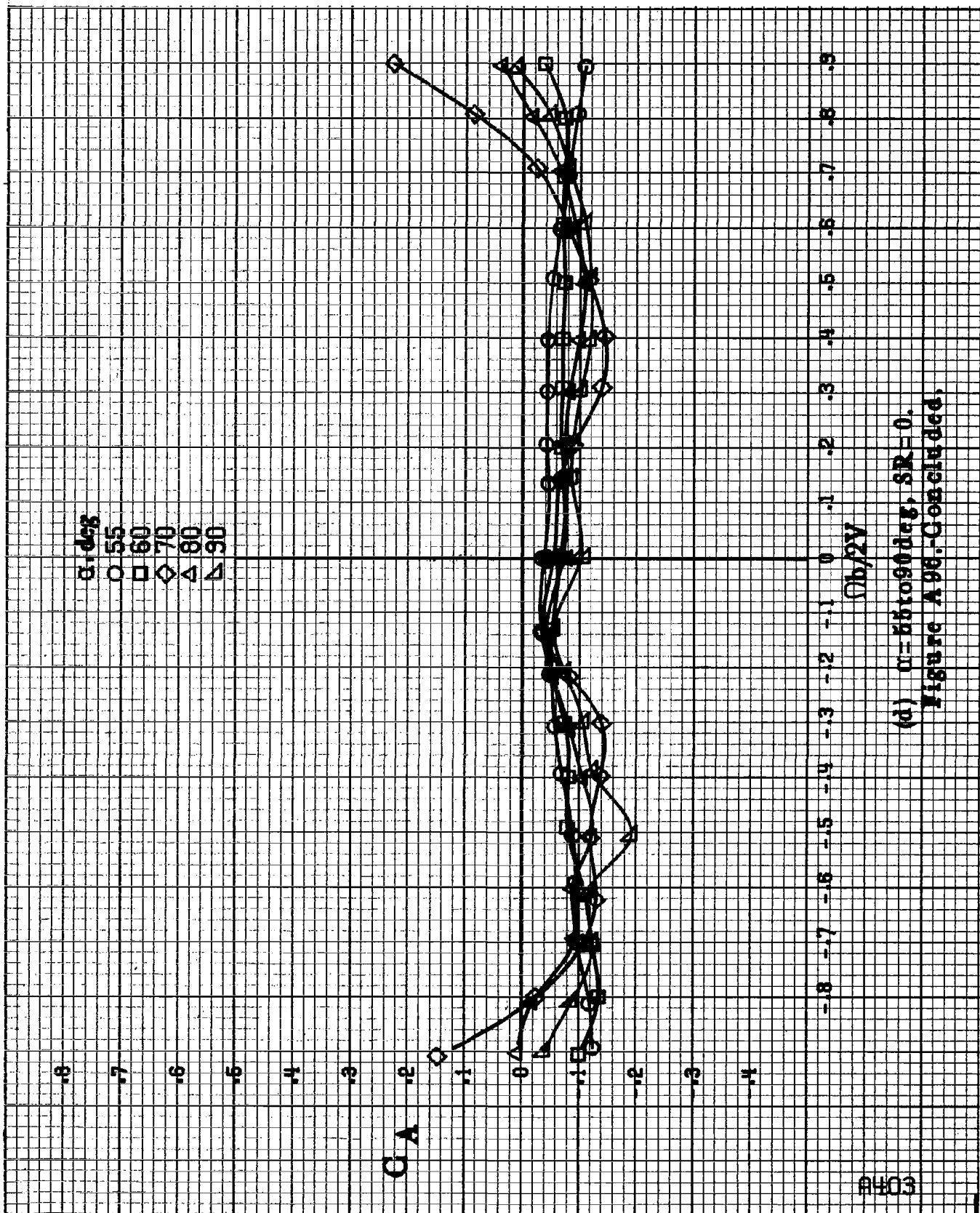
△ 45

▲ 50

$\Omega_b / 2V$

(c)  $\alpha = 30 \text{ to } 50 \text{ deg}$ ,  $SR = 0$ .  
Figure A 9B-Continued.





(d)  $\alpha=55$  to  $90^\circ$ ,  $SR=0$ .  
Figure A 96.-Continued,

84104

$\alpha, \text{deg}$   
 $\circ 8$   
 $\square 10$   
 $\diamond 12$   
 $\triangle 14$   
 $\nabla 16$

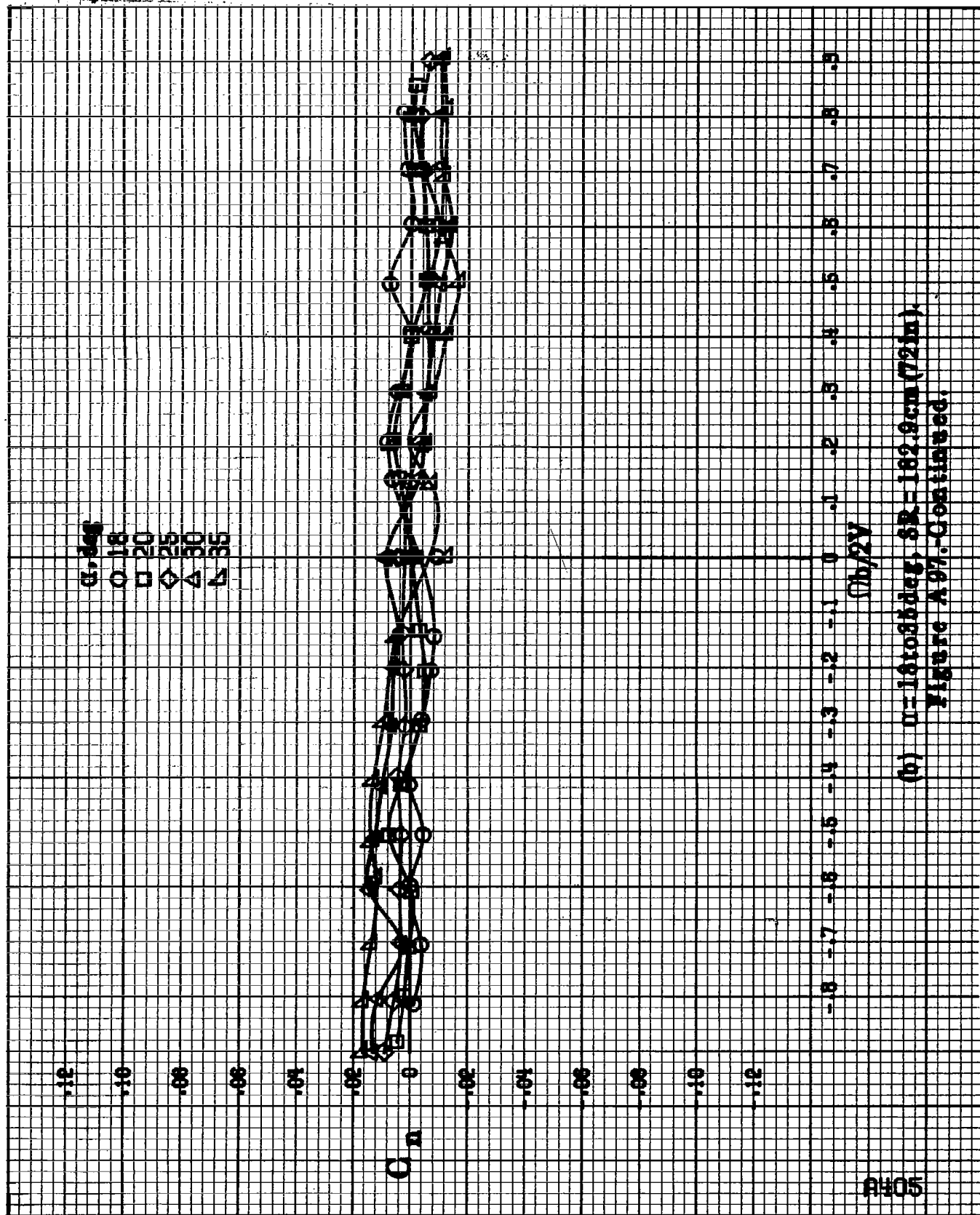
$C_n$

$\Omega b/2V$

(a)  $\alpha = 8$  to  $16$  deg,  $SR = 132.9$  cm (72 in.).

Figure A97. Effect of rotation rate and angle of attack on yawing moment coefficient for horizontal and vertical tails off configuration.  $\delta_r = 0^\circ$ ,  $\delta_a = 0^\circ$ .

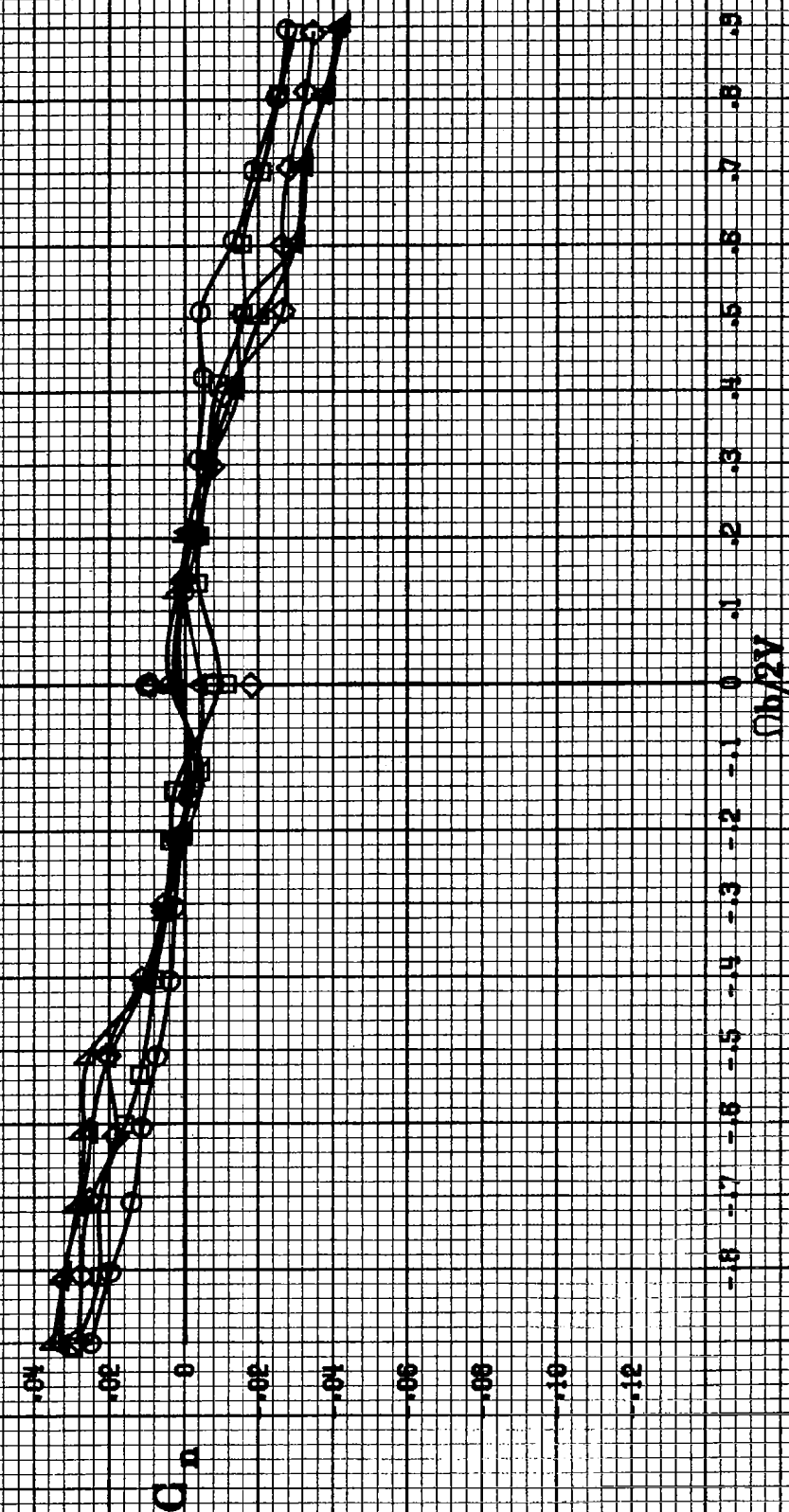




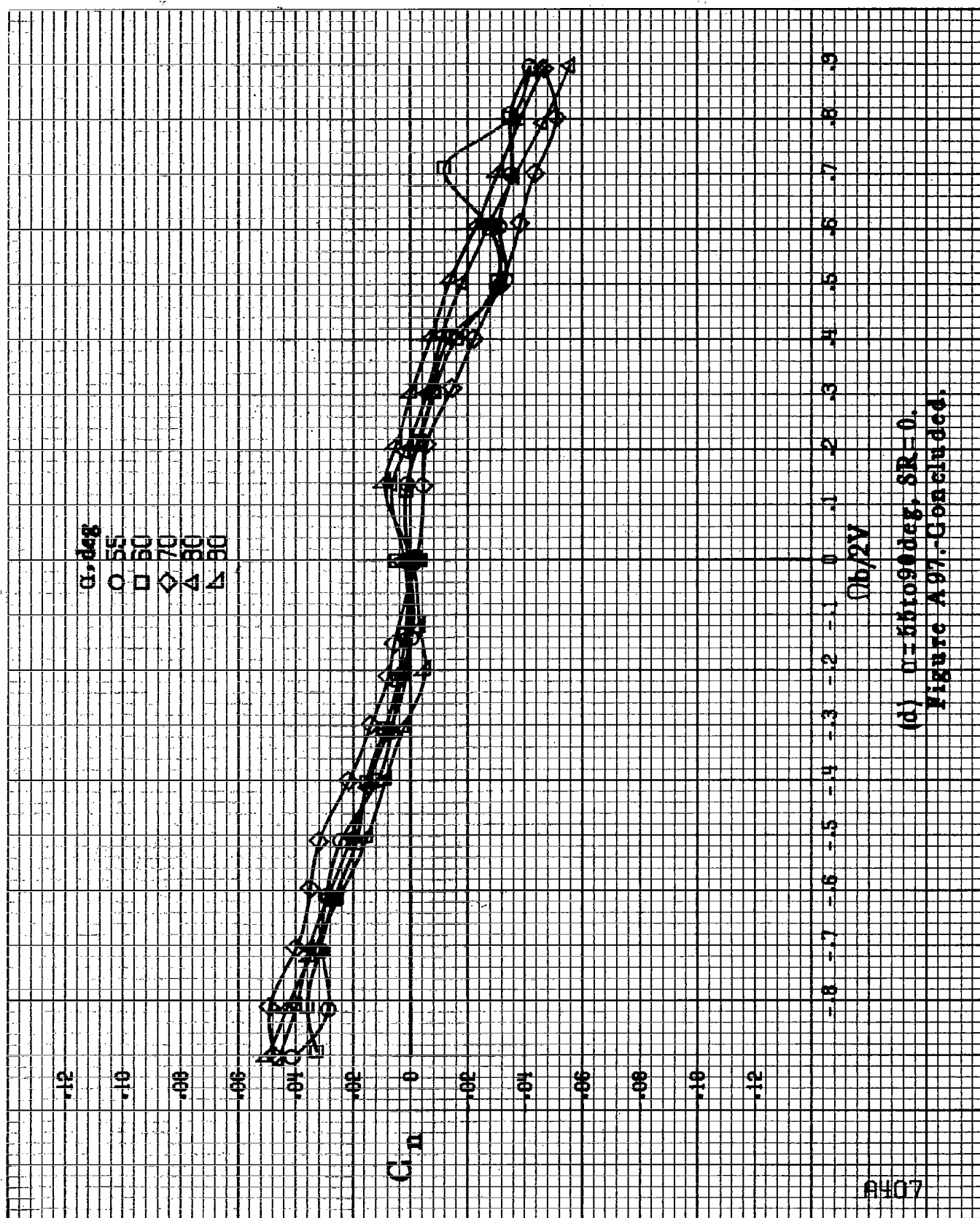
(b)  $\alpha = 18$  to  $36$  deg,  $SR = 182.9$  cm (72 in).  
Figure A 97.-Continued.

A406

$\phi$ , deg  
 0 30 35 40 45 50

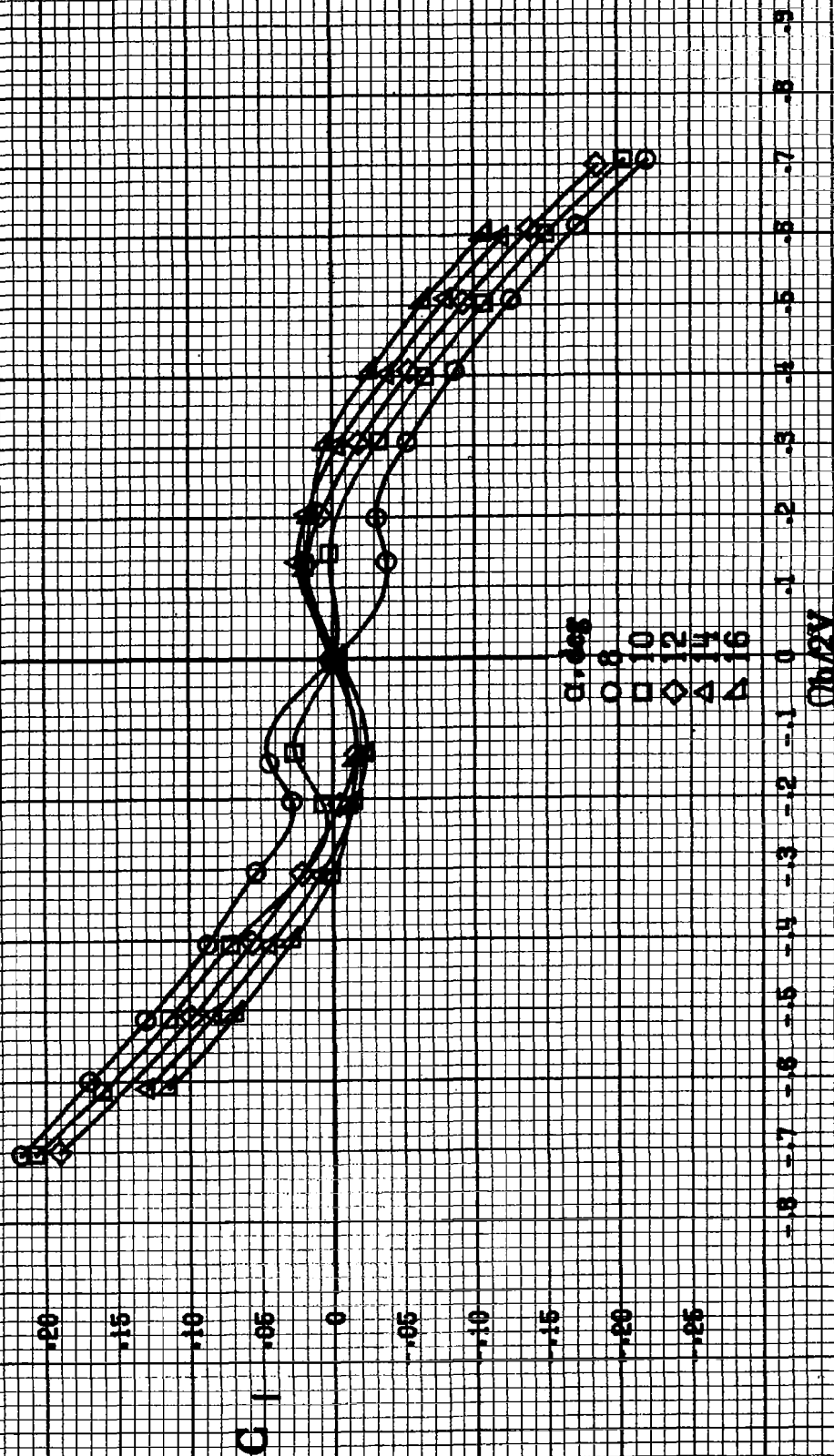


(c)  $\alpha = 80$  to  $0$  deg,  $SR = 0$ .  
 Figure A97.-Continued.



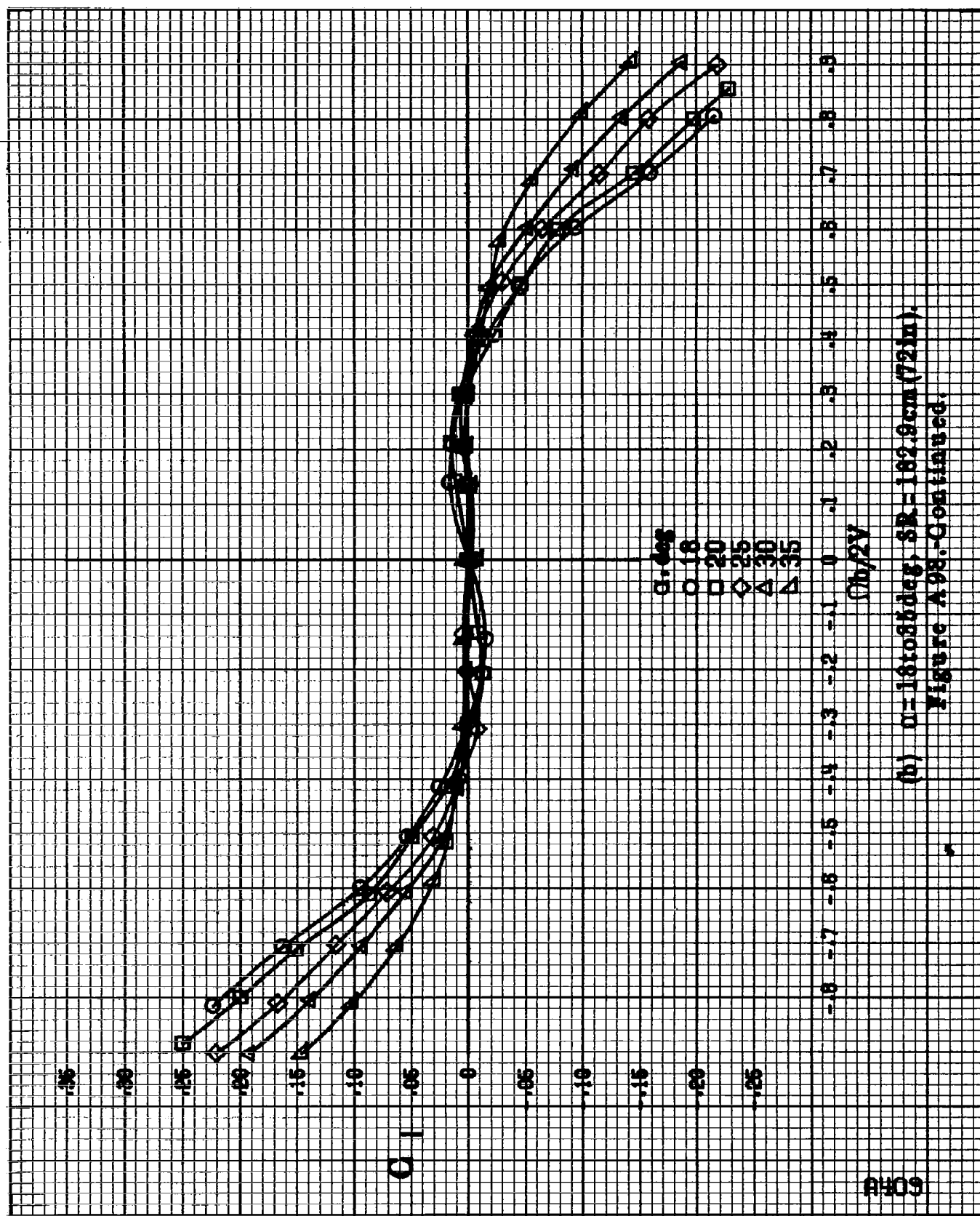
(d)  $\eta = 55$  to  $90^\circ$ ,  $SR = 0$ .  
 Figure A97.-Continued.

90748



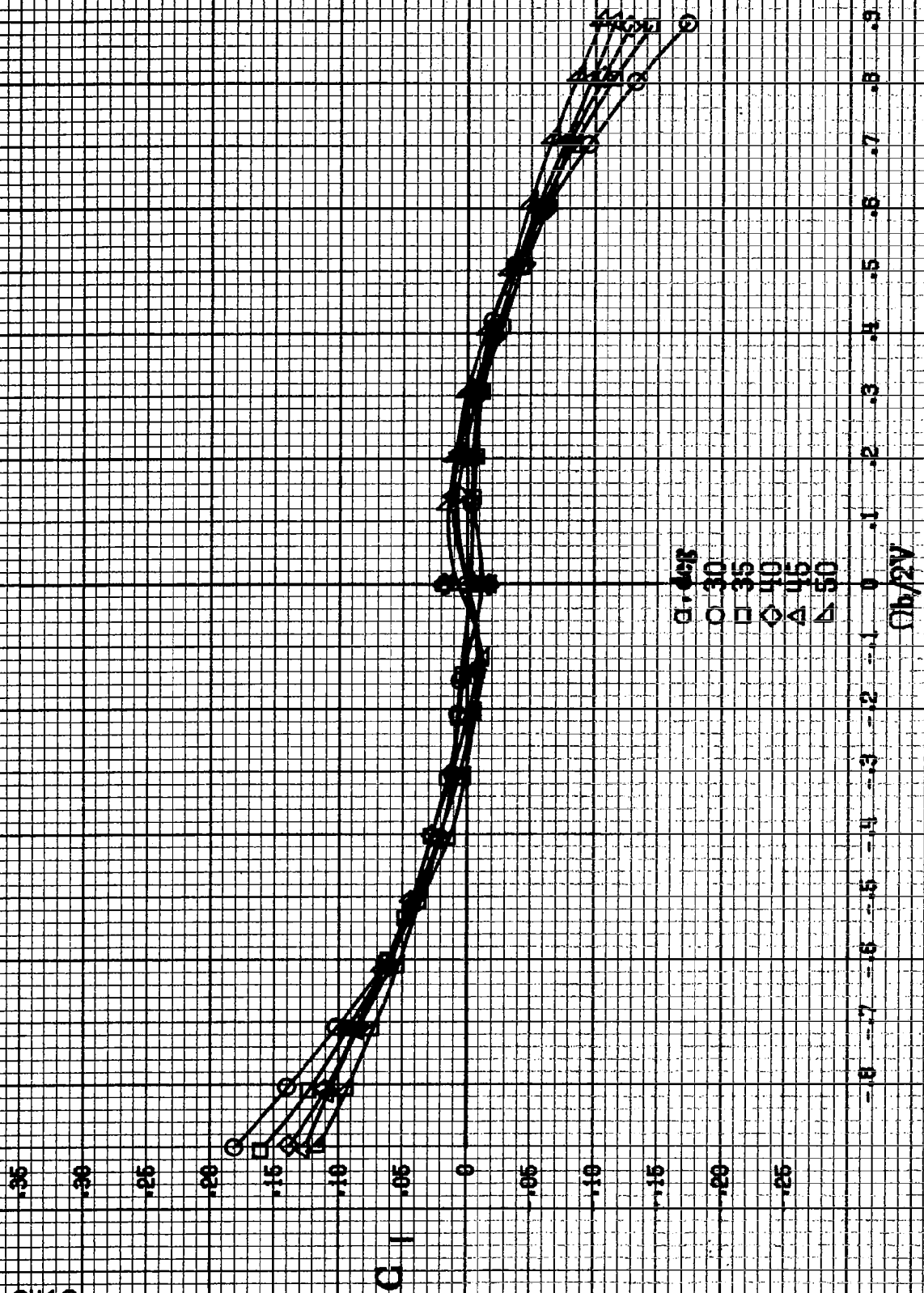
(a)  $\alpha = 8$  to  $18$  deg,  $SR = 182.9$  cm (72 in.).

Figure A-98. Effect of rotation rate and angle of attack on rolling-moment coefficient for horizontal and vertical tails off configuration.  $\delta_a = 0^\circ$ ,  $\delta_s = 0^\circ$ ,  $\delta_r = 0^\circ$ ,  $\theta = 0^\circ$ .

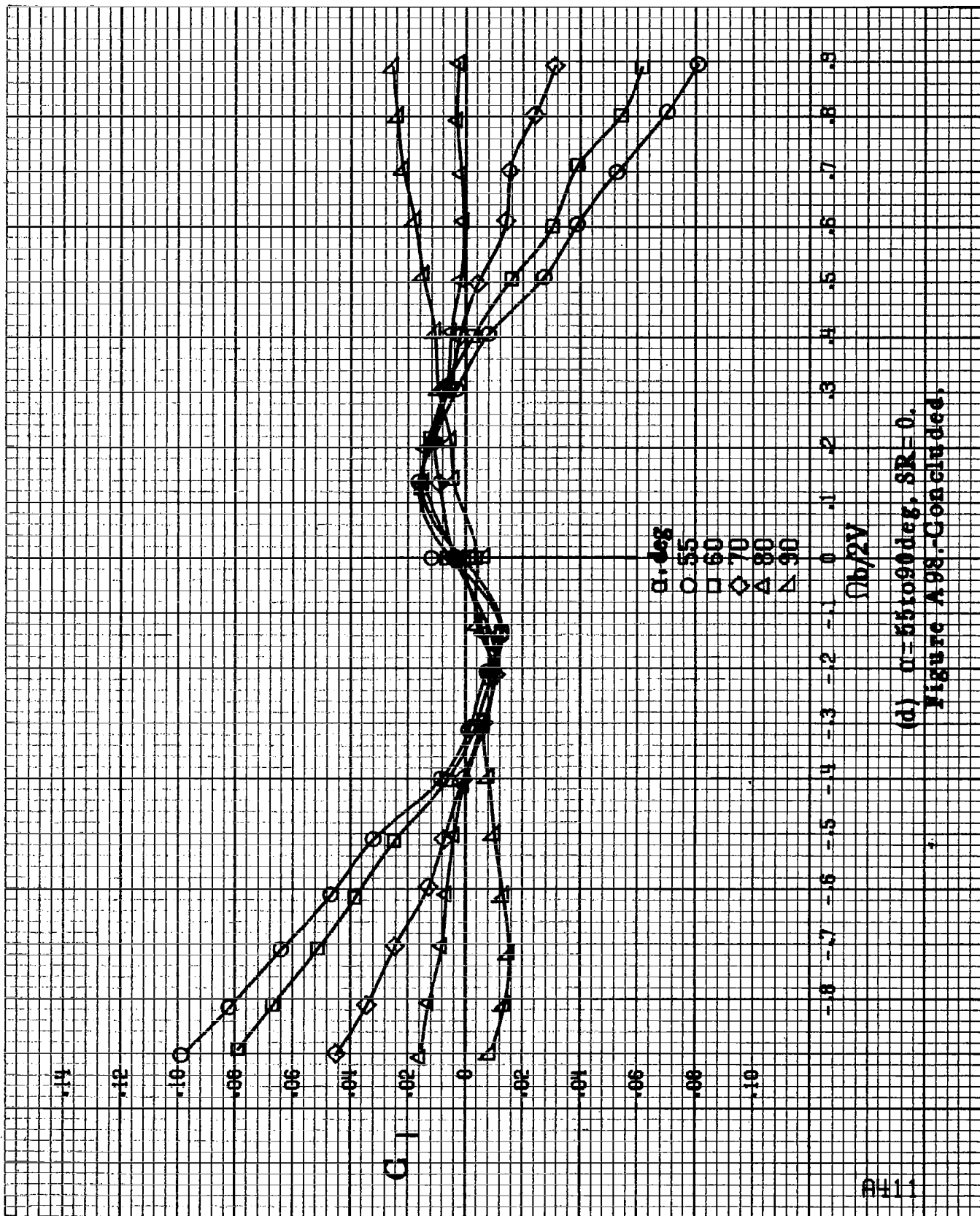


(b)  $\alpha = 18$  to  $85$  deg,  $SR = 182.9$  cm (72 in).  
Figure A98.-Continued.

8410



(c)  $\alpha = 30$  to  $60$  deg,  $SR = 0$ .  
Figure A98. Continued.



(d)  $\alpha = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A98.-Concluded.

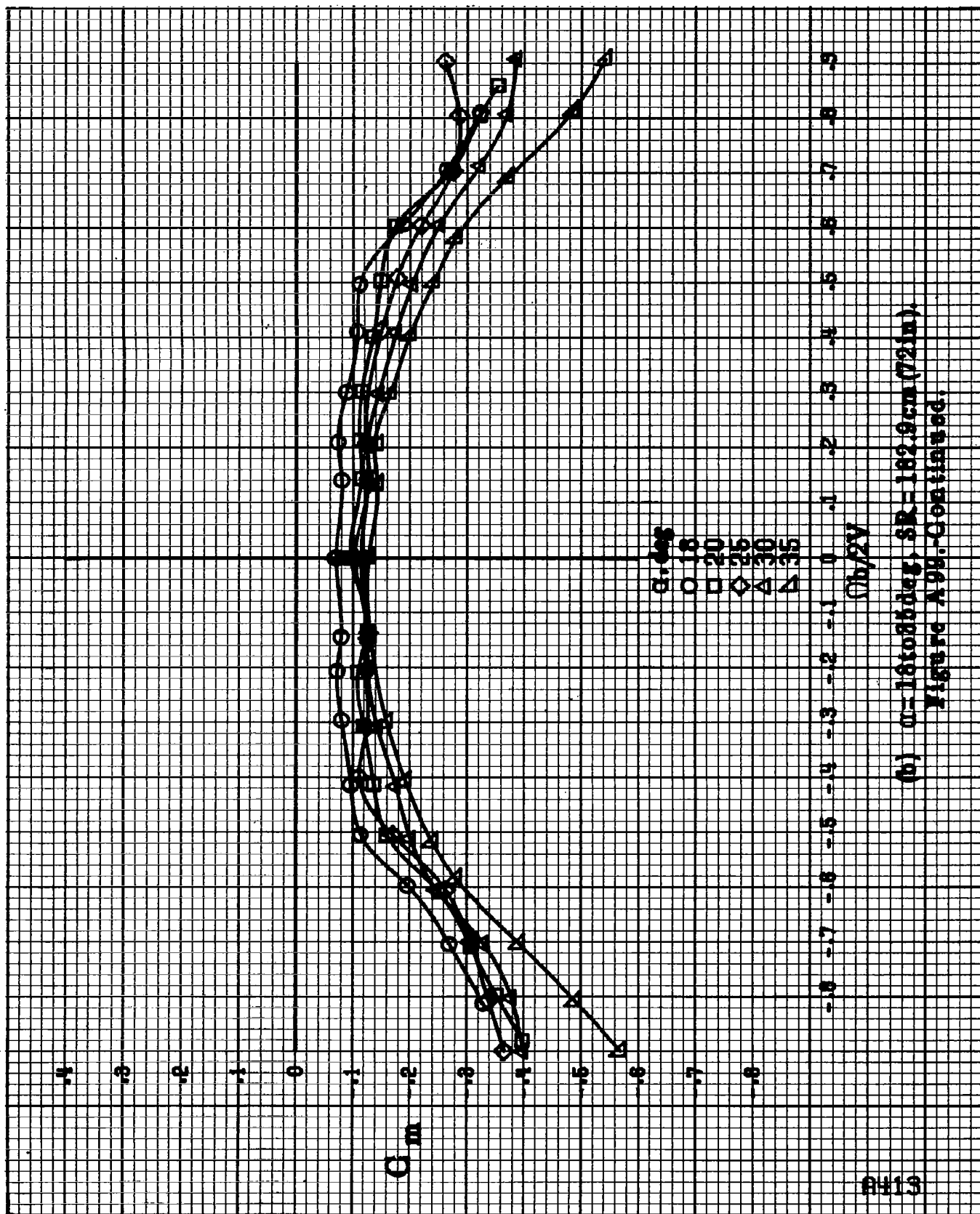
B412



(a)  $\alpha = 8^\circ$  to  $16^\circ$ ,  $SR = 182.5$  cm (72 in).

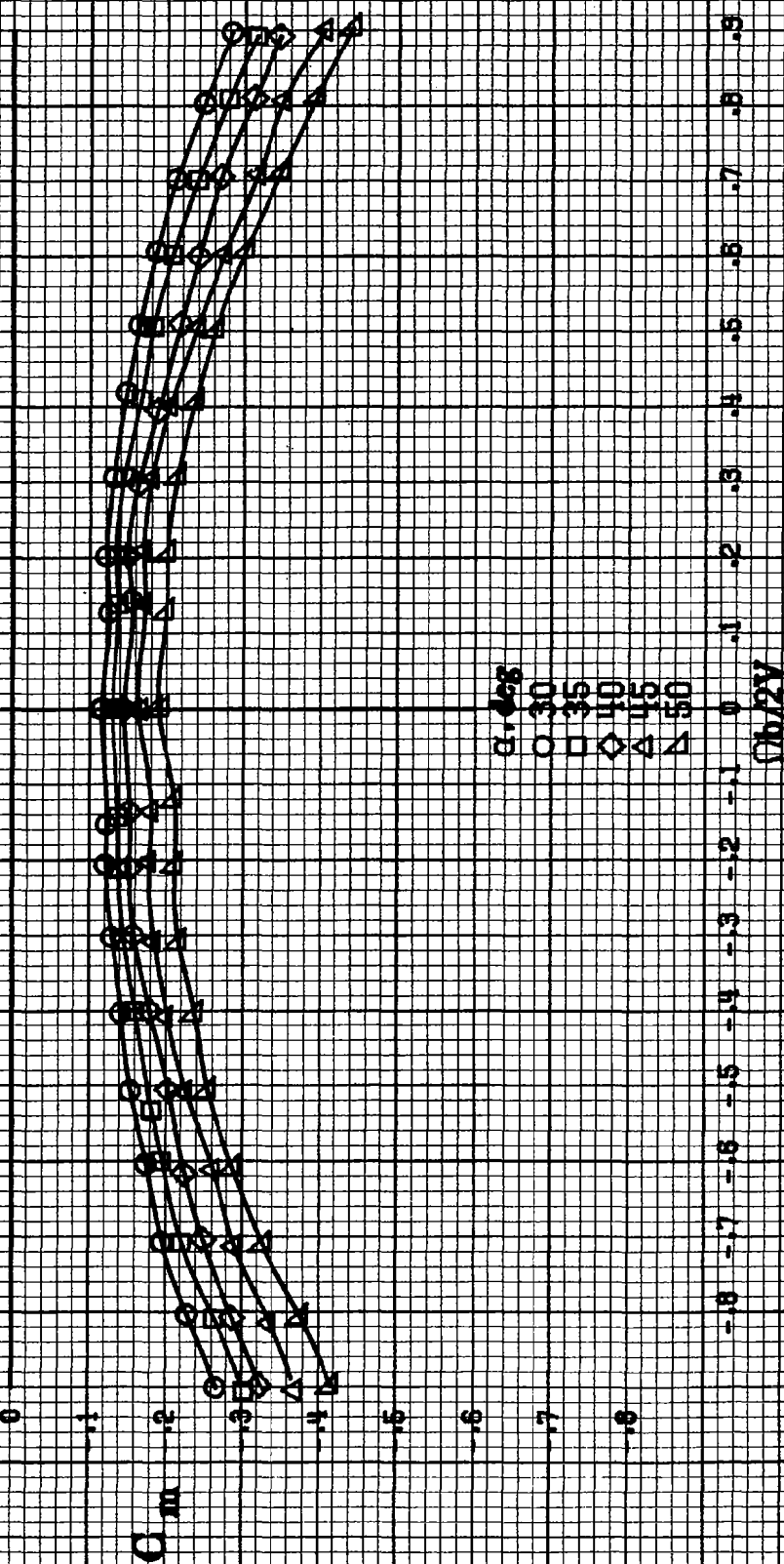
Figure A99: Effect of rotation rate and angle of attack on pitching moment coefficient for horizontal and vertical tails off configuration.  $\delta_a = 0^\circ$ ,  $\delta_e = 0^\circ$ .



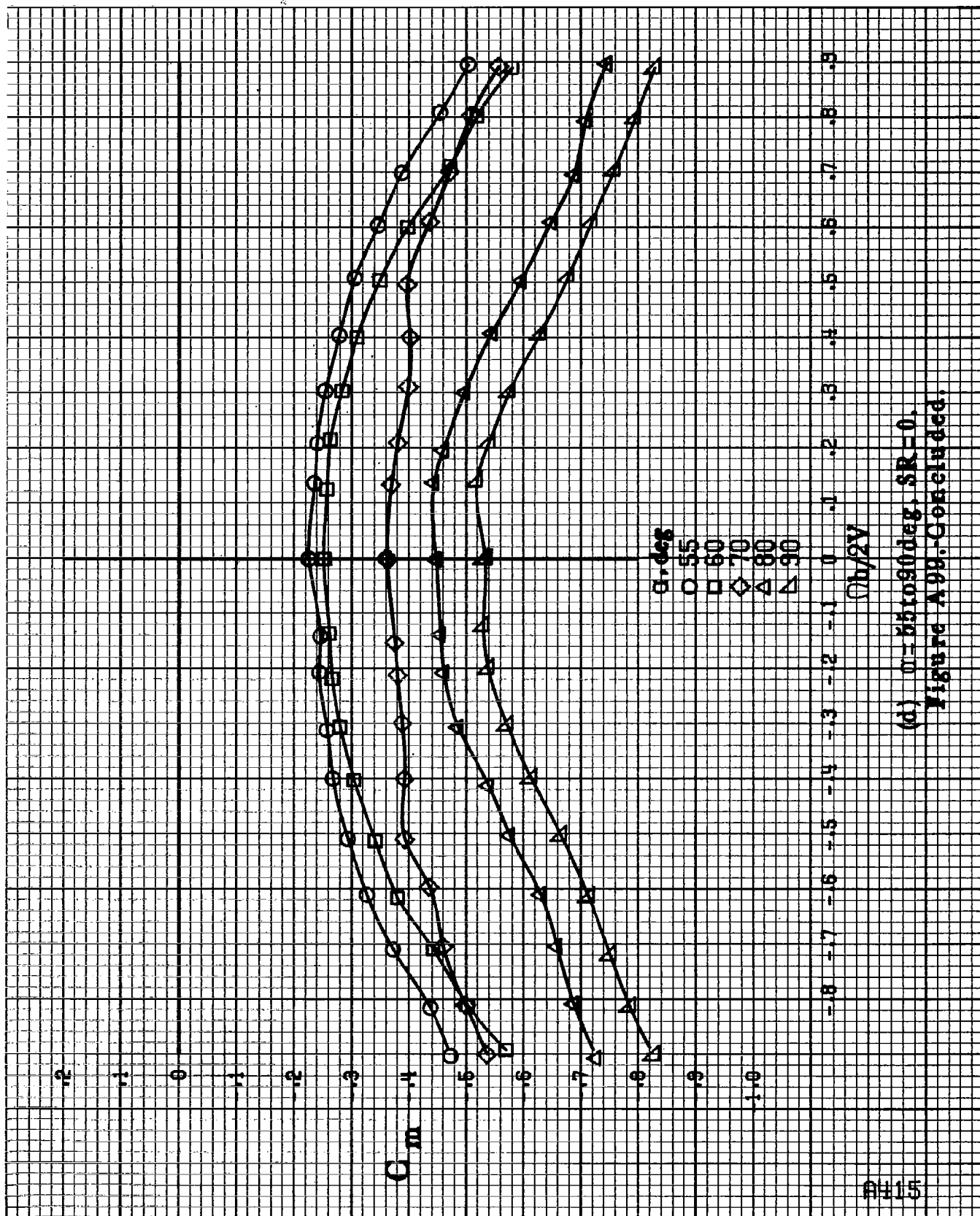


(b)  $\alpha = 16$  to  $85$  deg,  $SR = 182.9$  cm (72 in).  
Figure A98.-Continued.

9414



(c)  $\alpha = 30$  to  $50$  deg,  $SR = 0$ .  
Figure A99.-Continued.



(d)  $\theta = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A99. Concluded.

A416

$\alpha, \text{deg}$

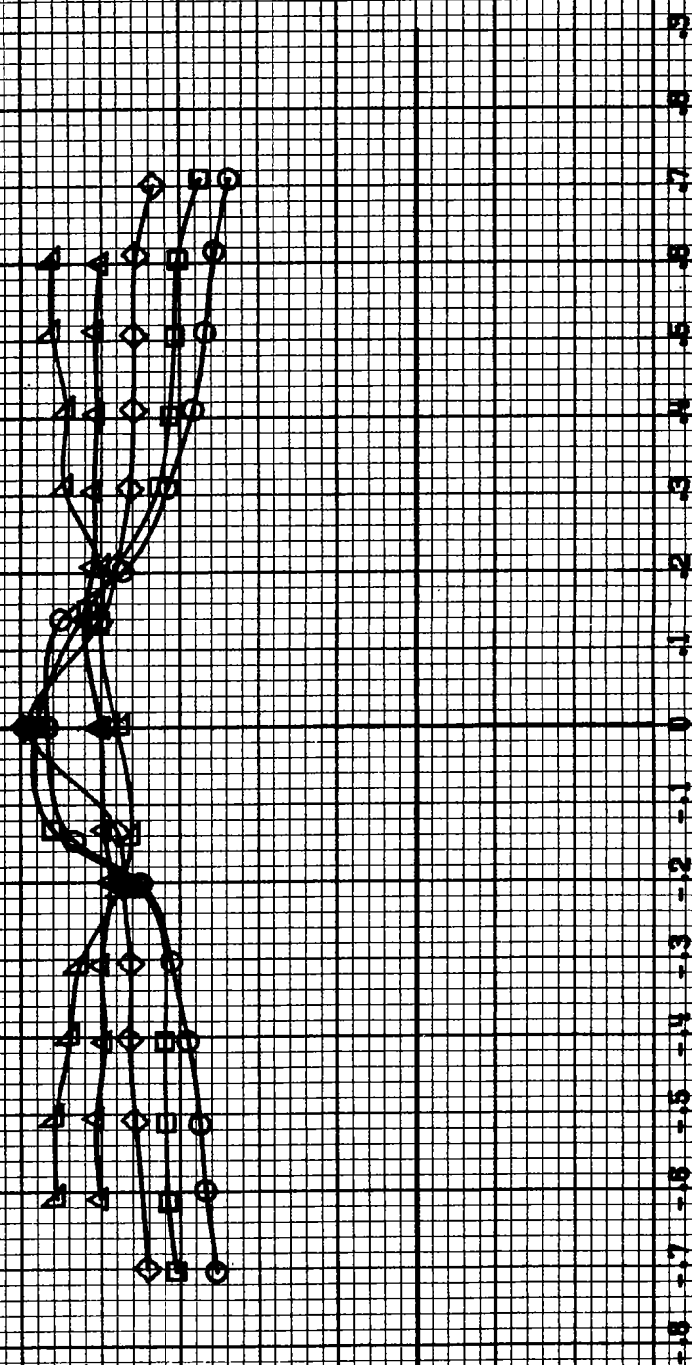
8  
10  
12  
14  
16

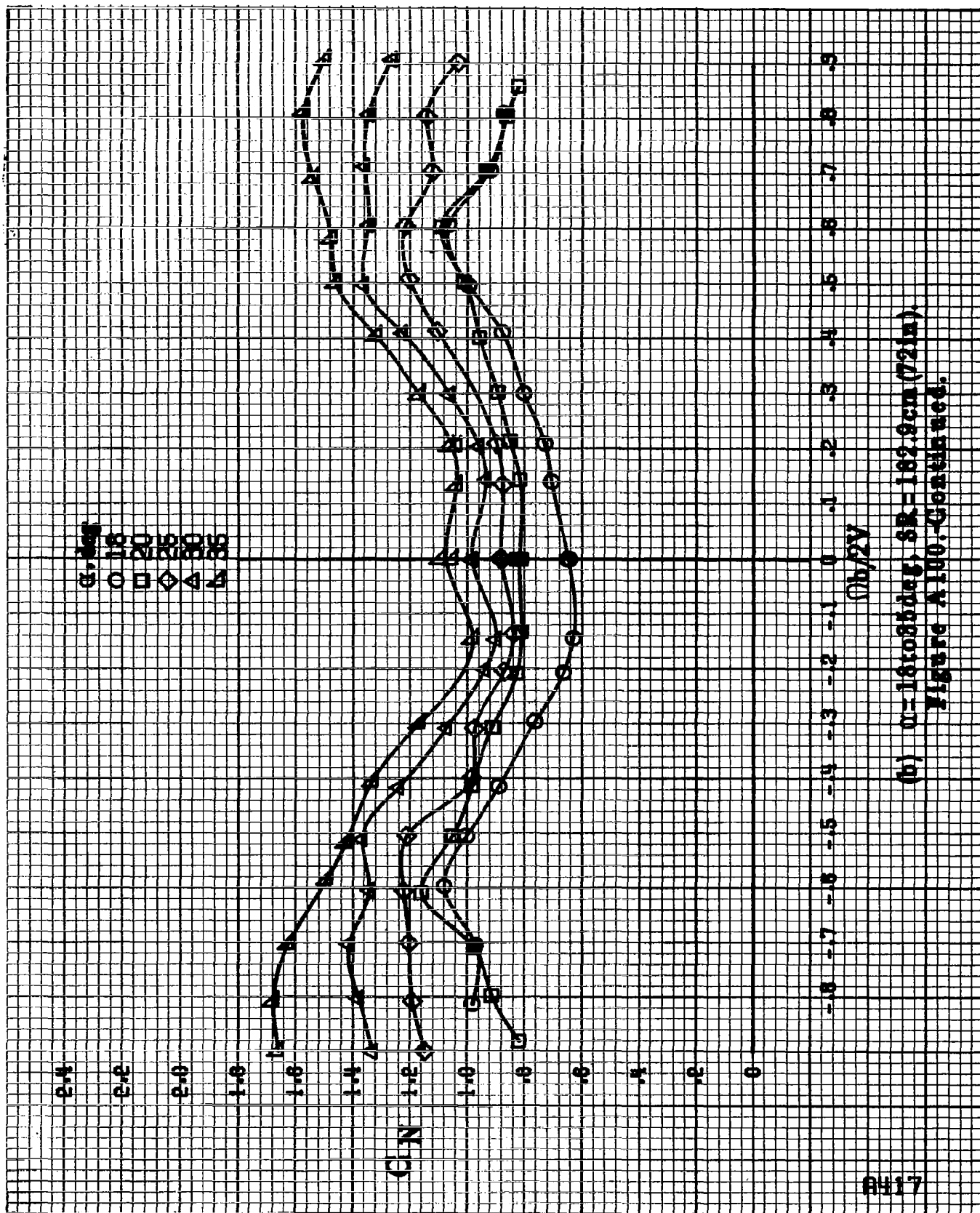
CN

$C_{D0}/2V$

(a)  $\alpha = 8 \text{ to } 16 \text{ deg}$ ,  $SR = 132.9 \text{ cm}$  (72 in).

Figure A100.-Effect of rotation rate and angle of attack on normal force coefficient for horizontal and vertical tails off configuration.  $\delta_s = 0^\circ$ ,  $\delta_a = 0^\circ$ ,  $\delta_v = 0^\circ$ .

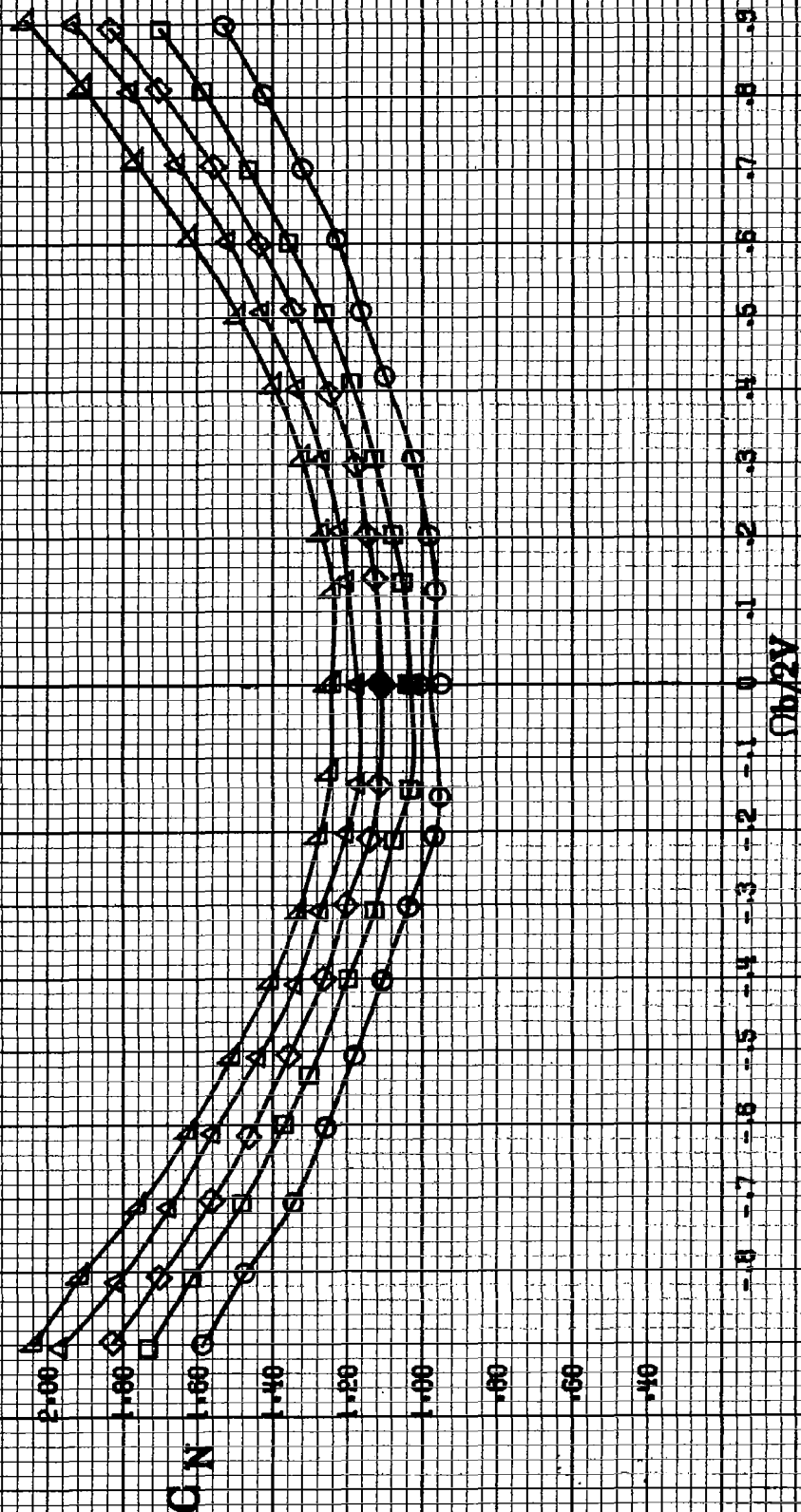




(b)  $\alpha = 181085 \text{ deg}$ ,  $SR = 182.9 \text{ cm (72 in)}$ .  
Figure A100-Continued.

8418

$\alpha, \text{deg}$   
 O 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▲ 50



(a)  $\mu = 80 \text{ rot/deg}$ ,  $SR = 0$ .  
 Figure A100-Continued.

$\sigma, \text{deg}$   
 55  
 60  
 70  
 80  
 90

3.0

2.8

2.6

2.4

CN

2.2

2.0

1.8

1.6

1.4

1.2

1.0

.8

.6

.9

.8

.7

.6

.5

.4

.3

.2

.1

0

-.1

-.2

-.3

-.4

-.5

-.6

-.7

-.8

$\sigma_b/2V$

(d)  $\sigma = 55$  to  $90$  deg,  $SR = 0$ .  
 Figure A100.-Concluded.

A420

$\alpha, \text{deg}$   
 8  
 10  
 12  
 14  
 16

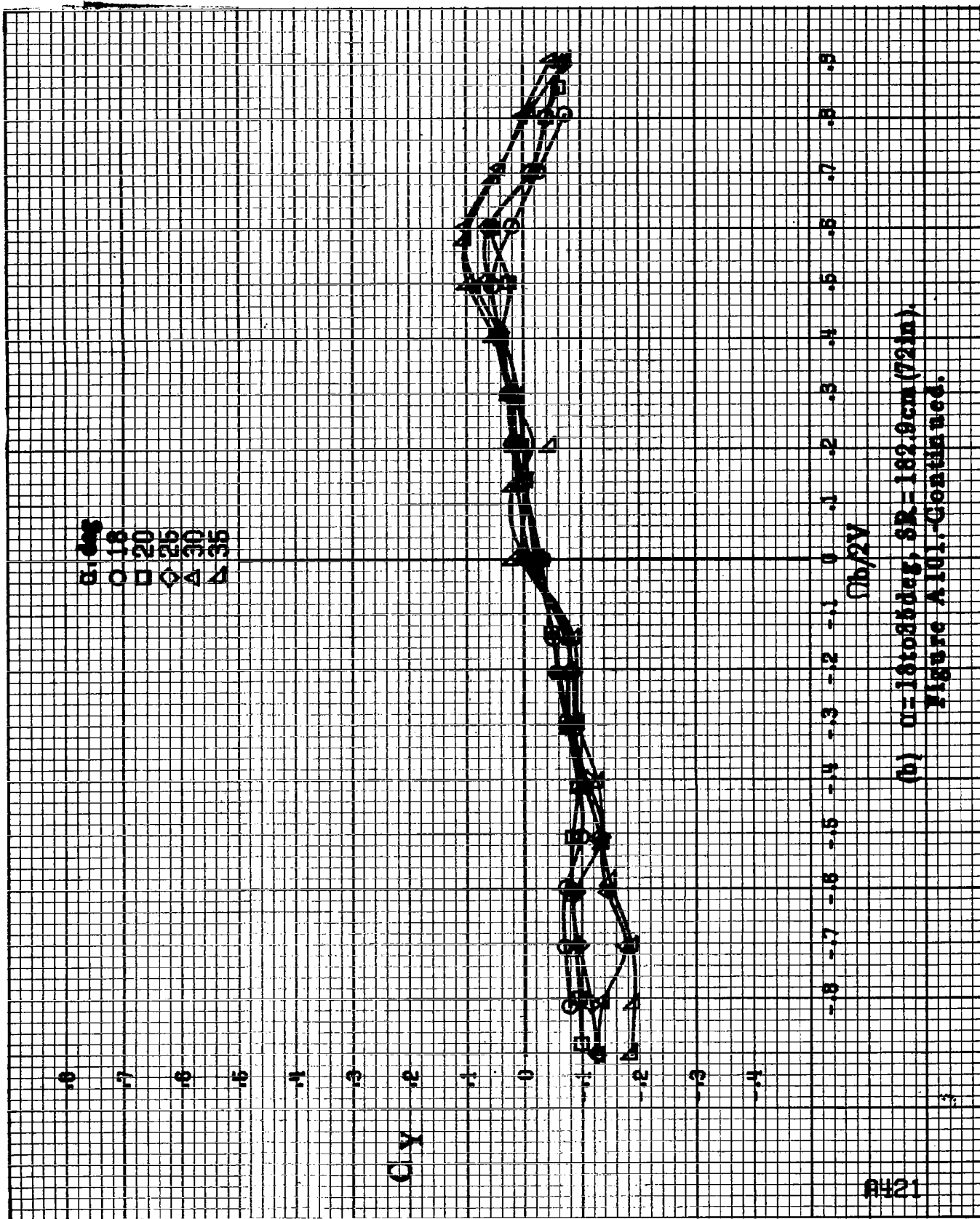
$C_Y$

$\Omega b/2V$

(a)  $\alpha = 8$  to  $16 \text{ deg}$ ,  $SR = 132.9 \text{ cm} (7/2 \text{ in})$ .

Figure A101.-Effect of rotation rate and angle of attack on side-force coefficient for horizontal and vertical tails off configuration.  $\delta_h = 0^\circ$ ,  $\delta_v = 0^\circ$ .





(b)  $\alpha = 18$  to  $35$  deg,  $SR = 182.9$  cm (72 in).  
Figure A10.1. Continued.

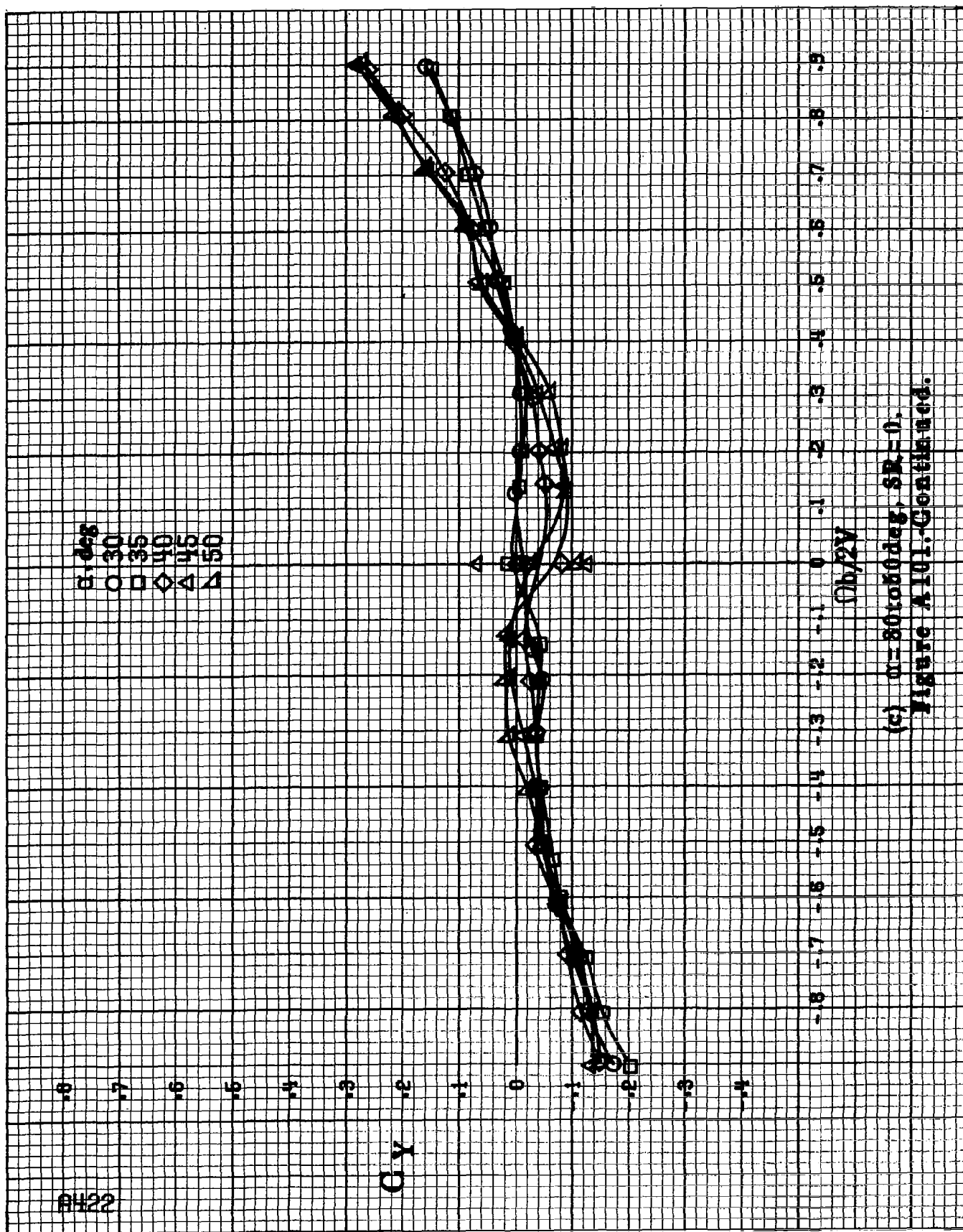
8422

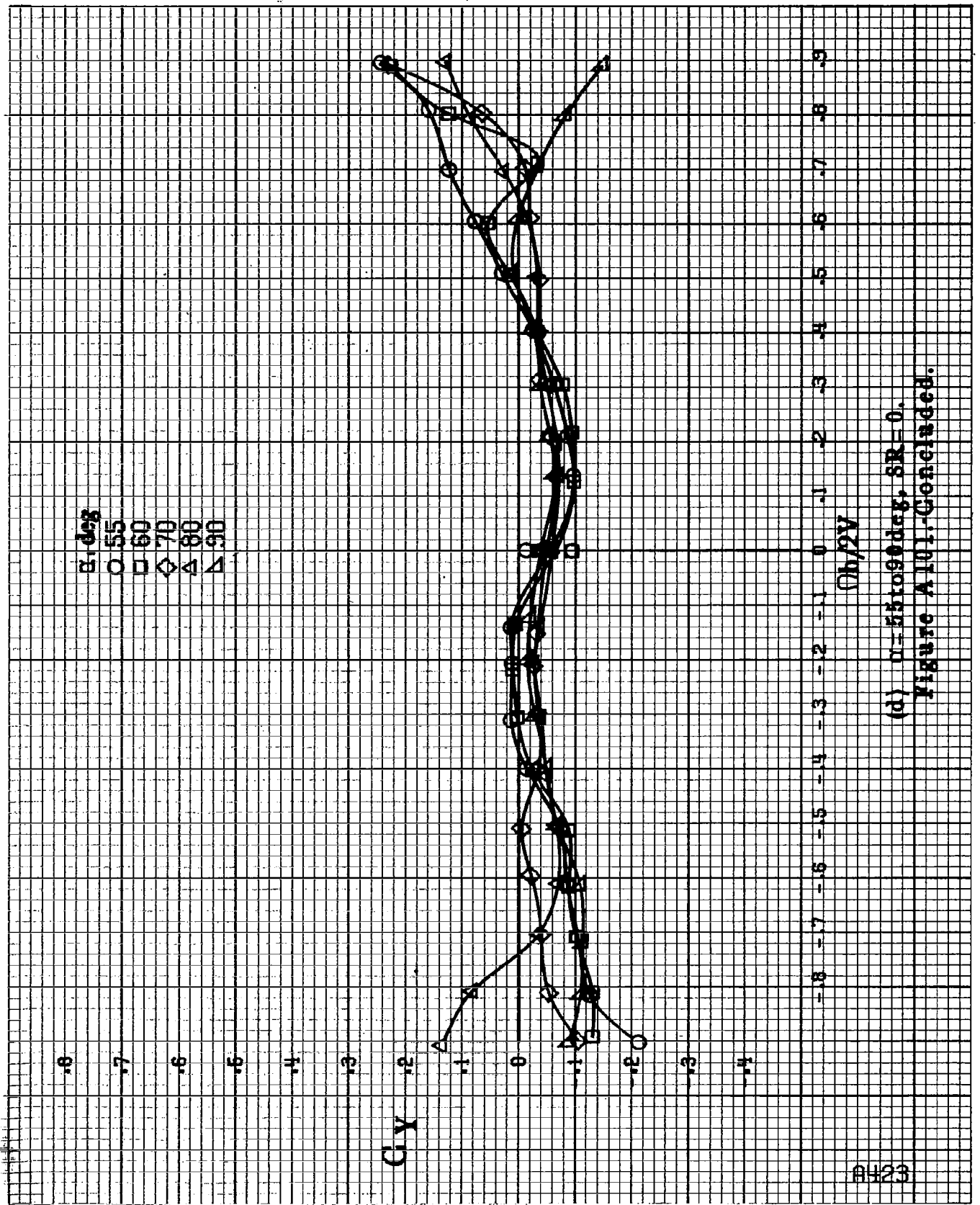
$\alpha, \text{deg}$   
 30  
 35  
 40  
 45  
 50

$C_Y$

$\alpha_b/2V$

(c)  $\alpha=80$  to  $80 \text{ deg}$ ,  $SR=0$ .  
 Figure A101-Continued.





(d)  $\alpha = 55$  to  $90^\circ$ ,  $\delta R = 0$ .  
Figure A101-Concluded.

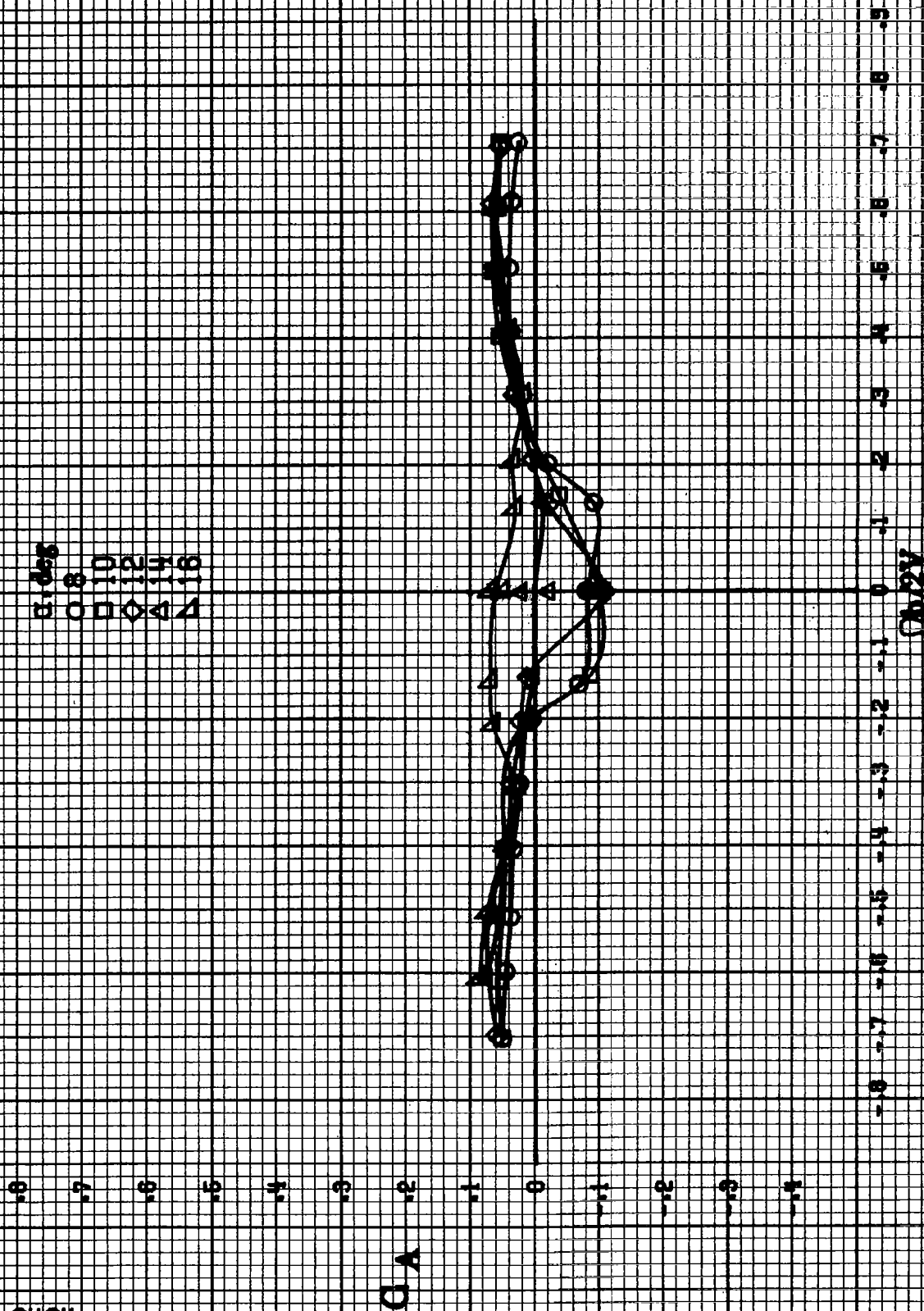
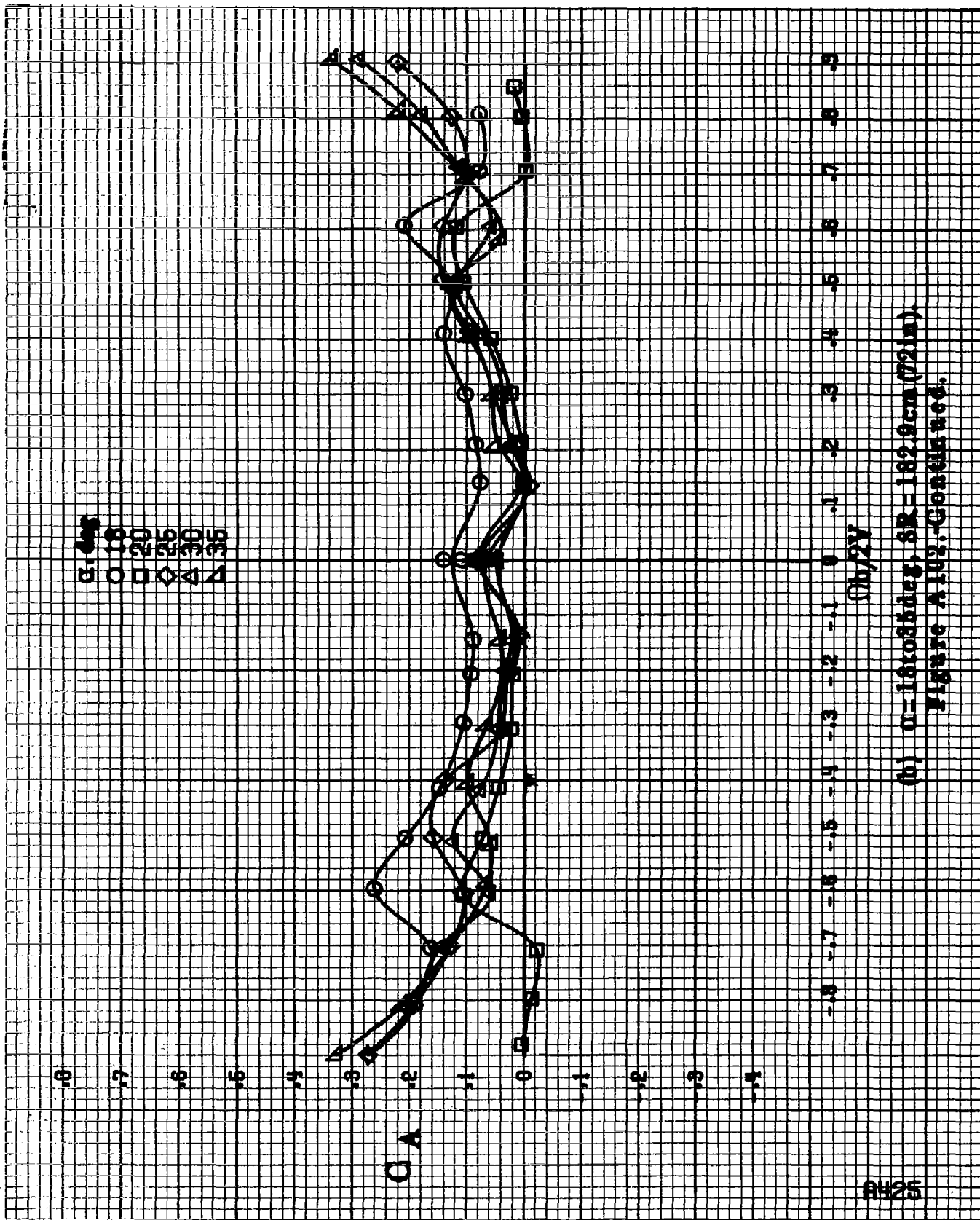
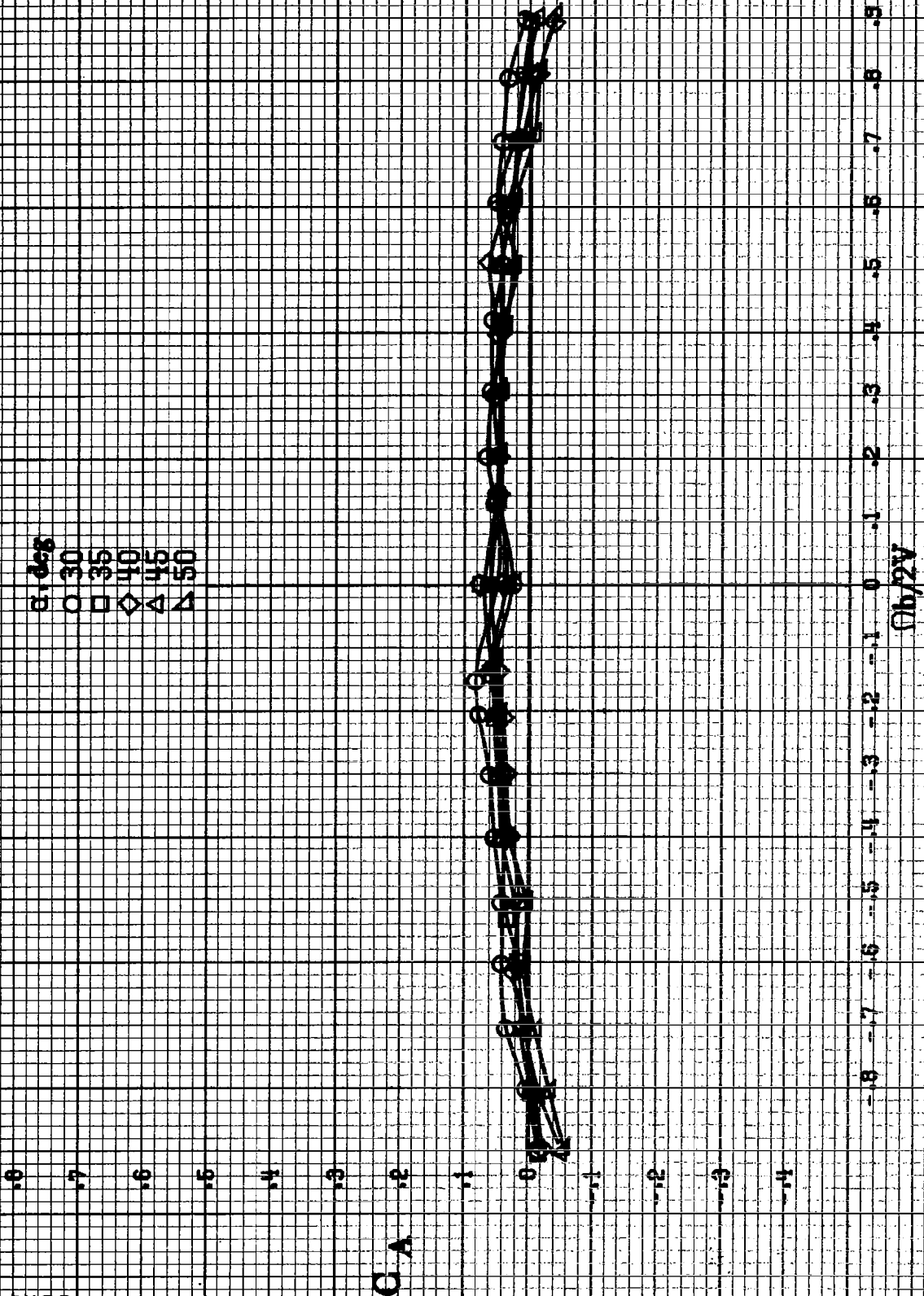


Figure A102.-Effect of rotation rate and angle of attack on calculated coefficient for horizontal and vertical tail off configuration.  $\delta_s = 0^\circ$ ,  $\delta = 0^\circ$ .  
(a)  $\alpha = 8$  to  $16$  deg,  $SL = 182.9$  cm (72 in.).

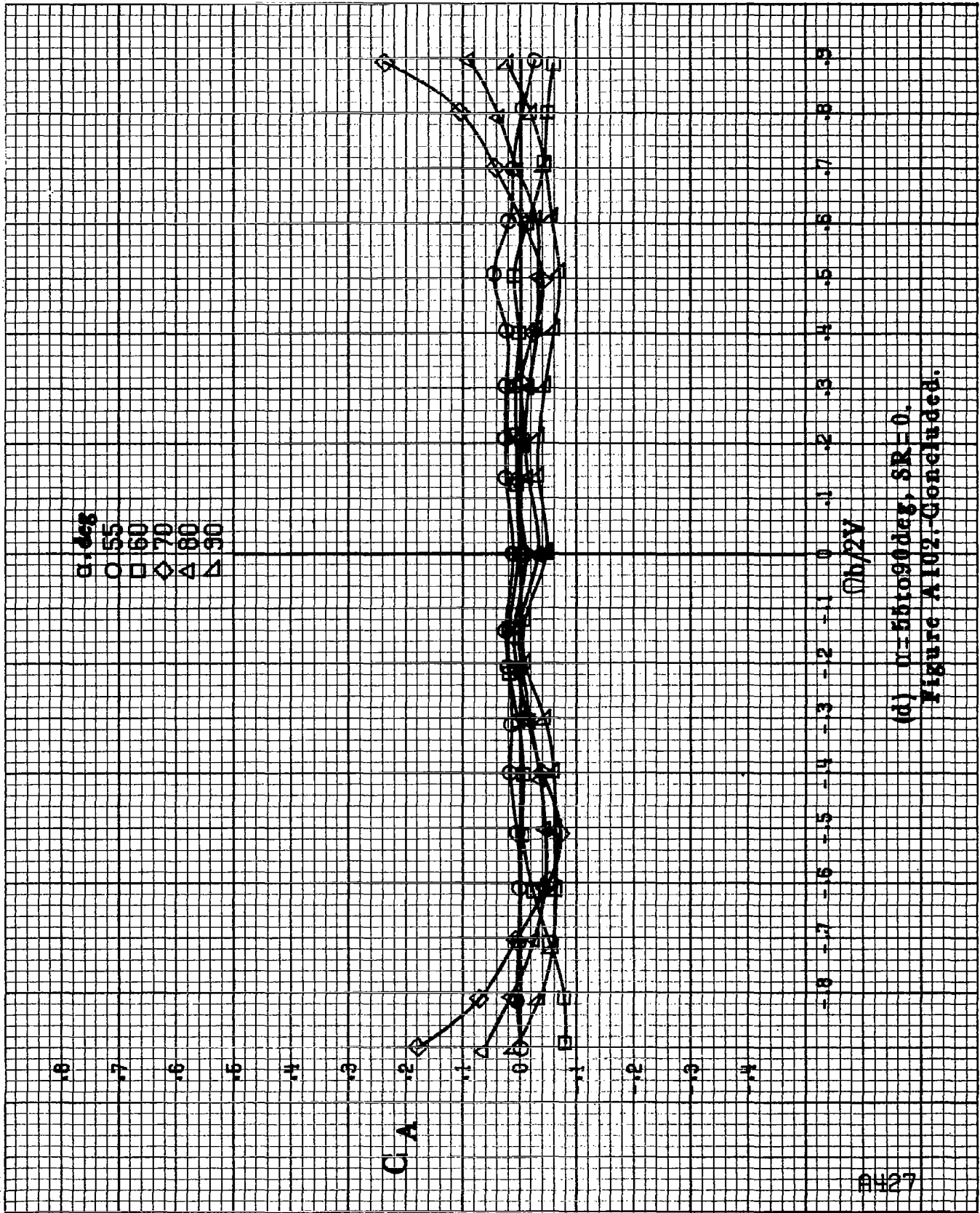


(b)  $\theta = 18.085^\circ$ ,  $\delta R = 182.9 \text{ cm}$  (721m).  
Figure A102-Continued.

B426



(c)  $\alpha = 30$  to  $50$  deg,  $SR = 0$ ,  
Figure A102-Continued.



(d)  $\theta = 55^\circ$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A102: Concluded.

8428

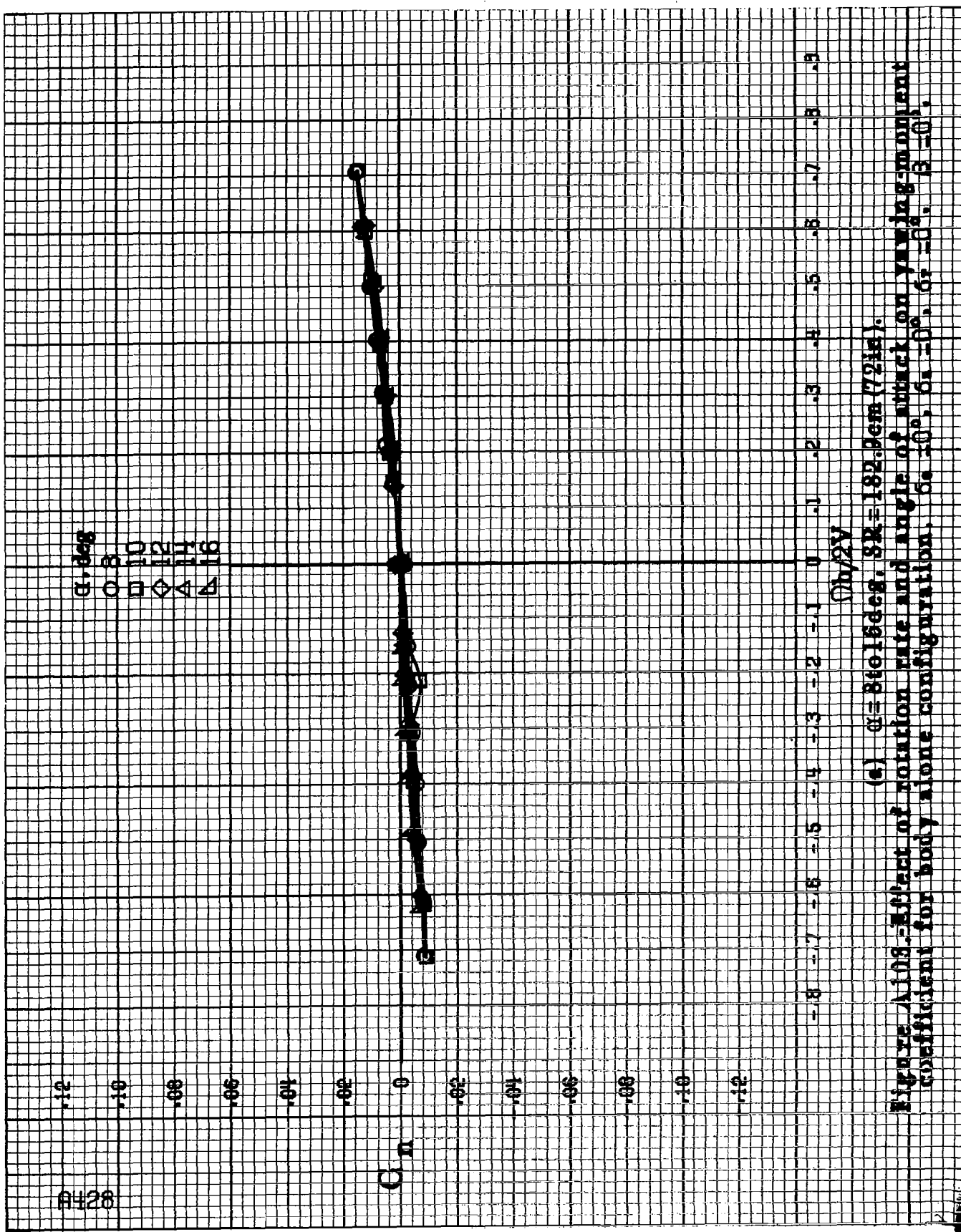
$\alpha = 8^\circ$   
 $\alpha = 10^\circ$   
 $\alpha = 12^\circ$   
 $\alpha = 14^\circ$   
 $\alpha = 16^\circ$

$C_n$

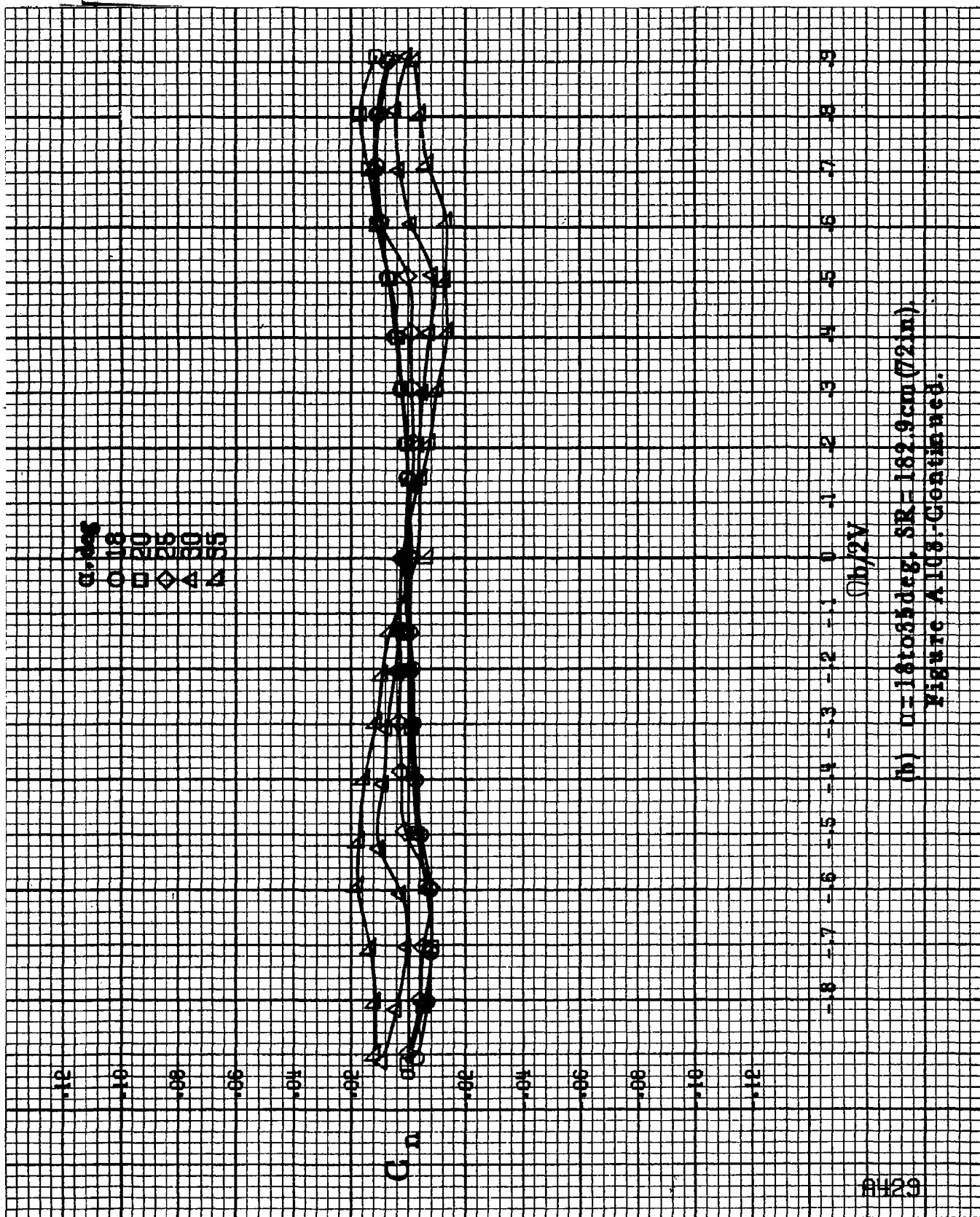
$\Omega b/2V$

(a)  $\alpha = 8$  to  $16^\circ$ ,  $SR = 182.3 \text{ cm (72 in.)}$ .

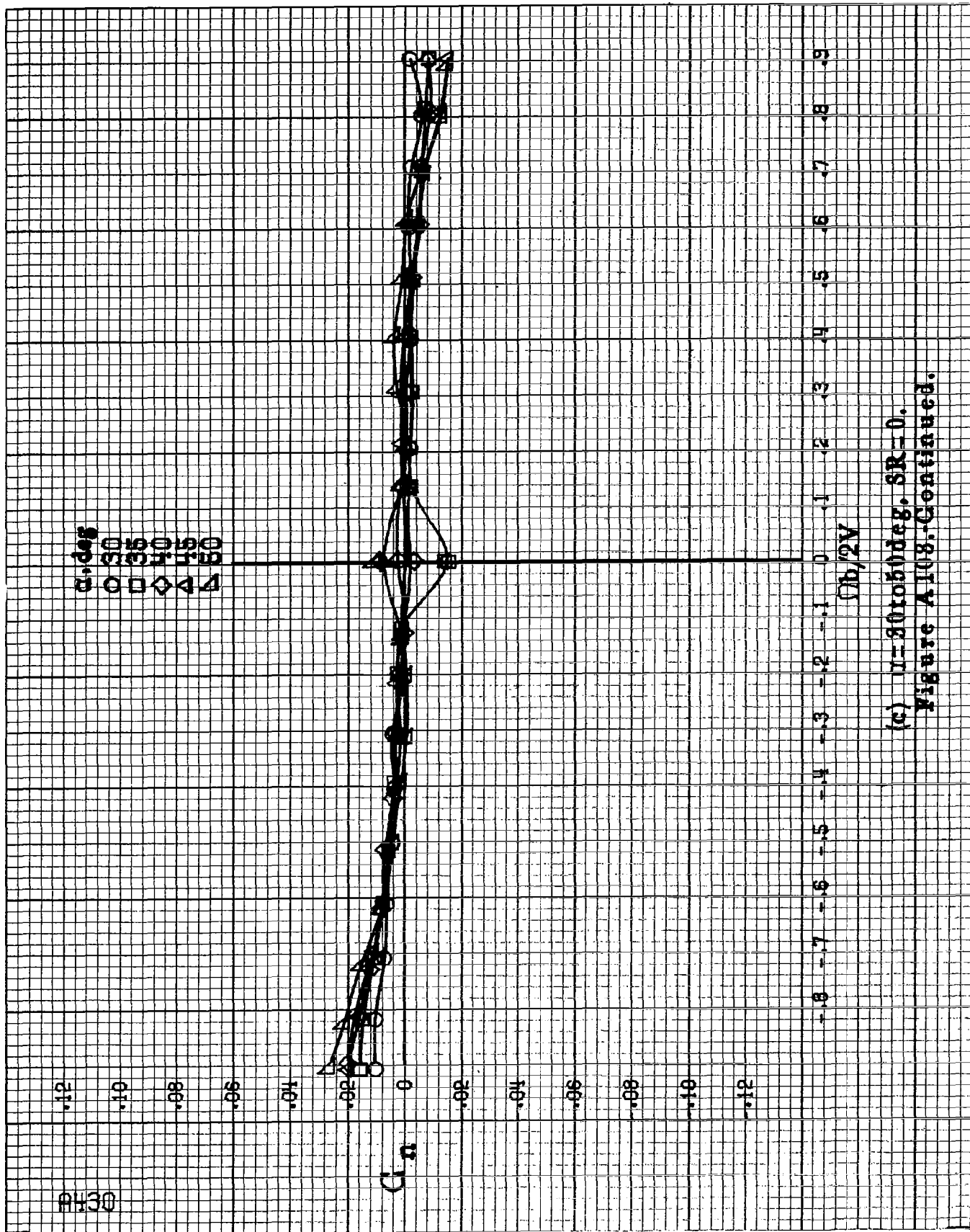
Figure A103.-Effect of rotation rate and angle of attack on yawing-moment coefficient for body alone configuration.  $\alpha = 0^\circ, 6^\circ, 10^\circ, 12^\circ, 14^\circ, 16^\circ$ .



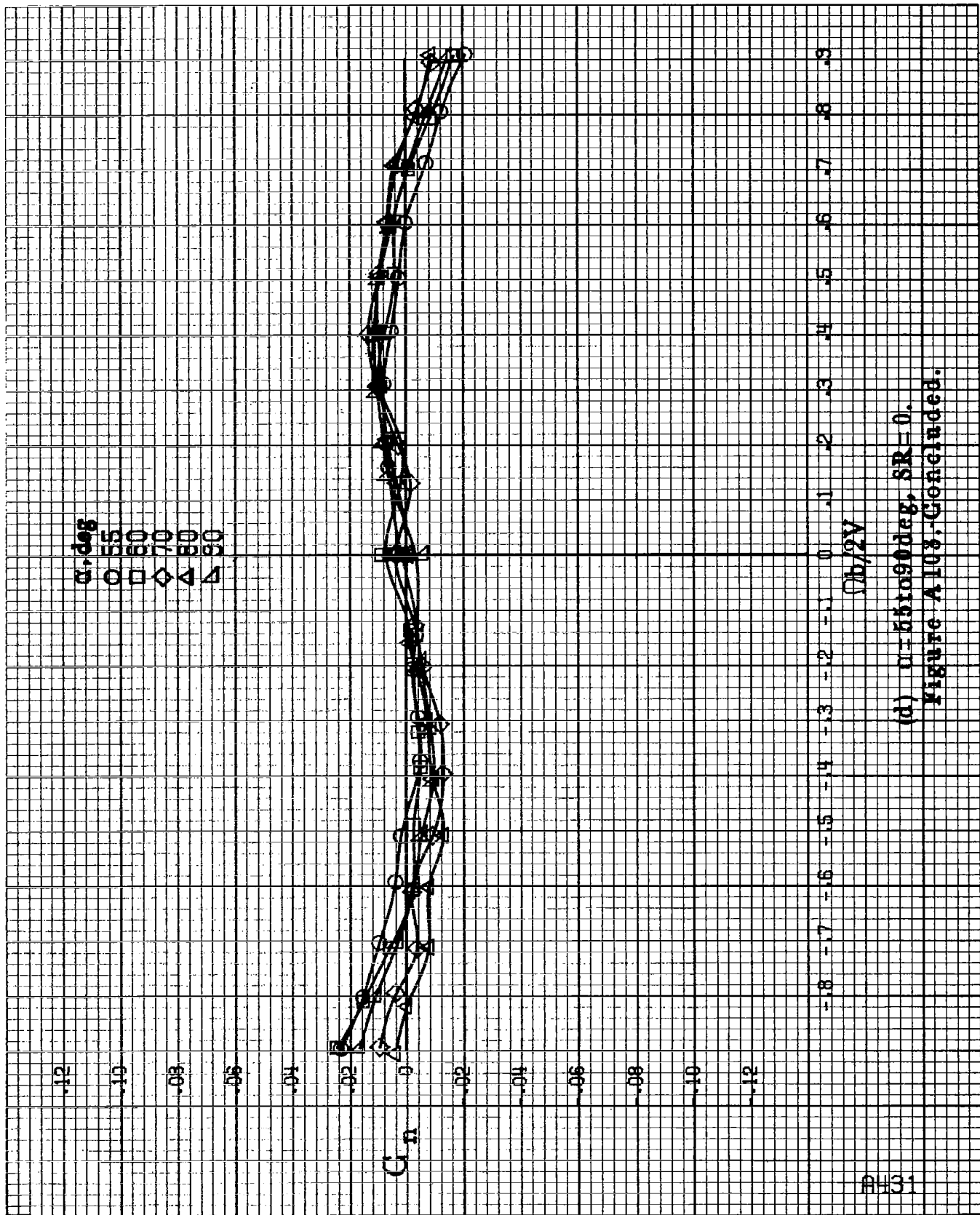




(b)  $D=1.8 \times 10^{-3}$  deg,  $SR=182.9$  cm (72 in).  
Figure A103. Continued.



(c)  $\alpha = 30$  to  $50$  deg.  $SR = 0$ .  
Figure A108-Continued.



(d)  $\Omega = 55$  to  $90$  deg,  $SR = 0$ .  
Figure A103. Concluded.

8432

C I .02

.14

.12

.10

.08

.06

.04

.02

0

-.02

-.04

-.06

-.08

-.10

-.8 -.7 -.6 -.5 -.4 -.3 -.2 -.1 0 .1 .2 .3 .4 .5 .6 .7 .8 .9

$\alpha$ , deg

0.8

1.0

1.2

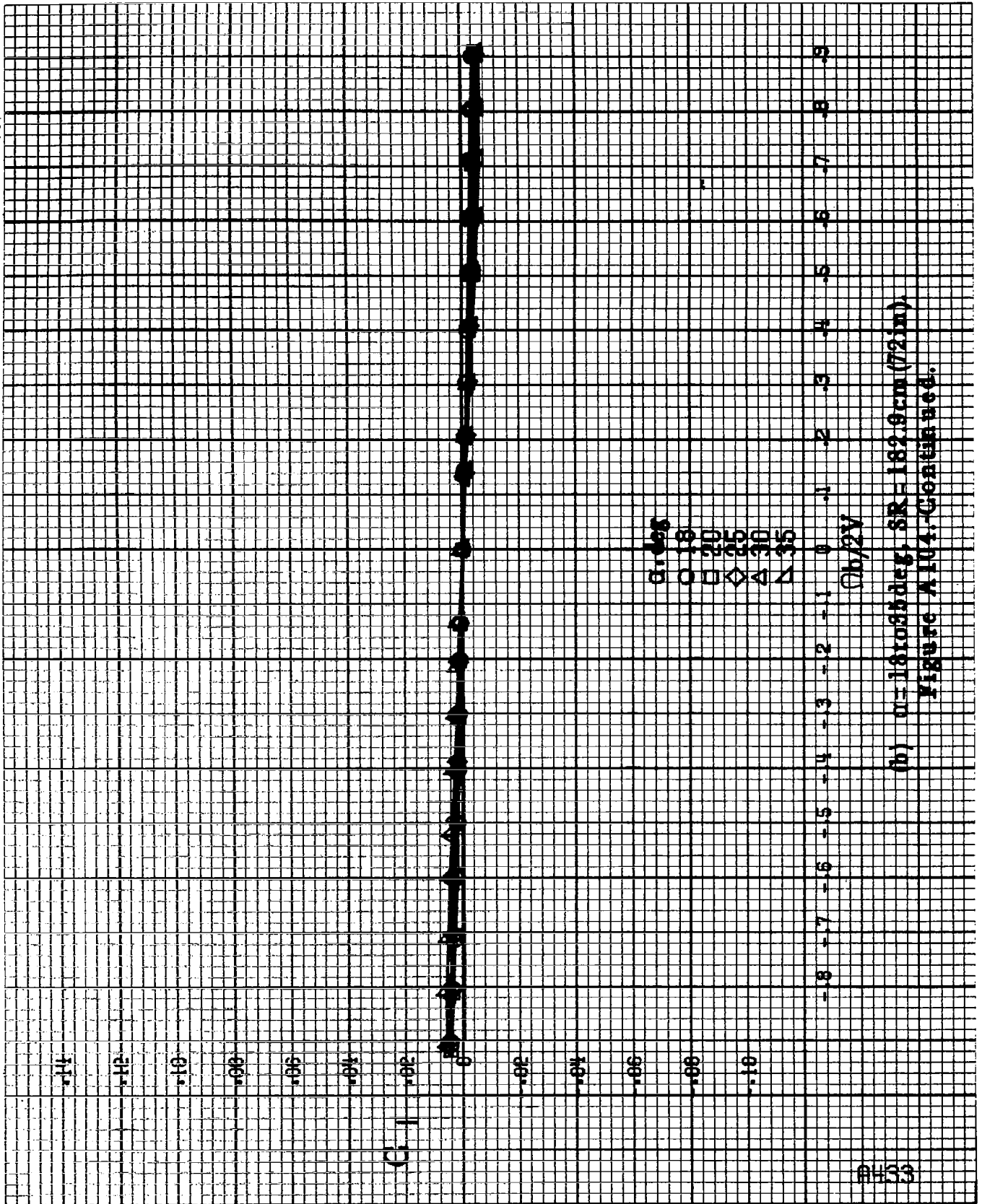
1.4

1.6

$\phi$ , deg

(a)  $\alpha = 8$  to  $15$  deg,  $SR = 182.9$  cm (72 in).

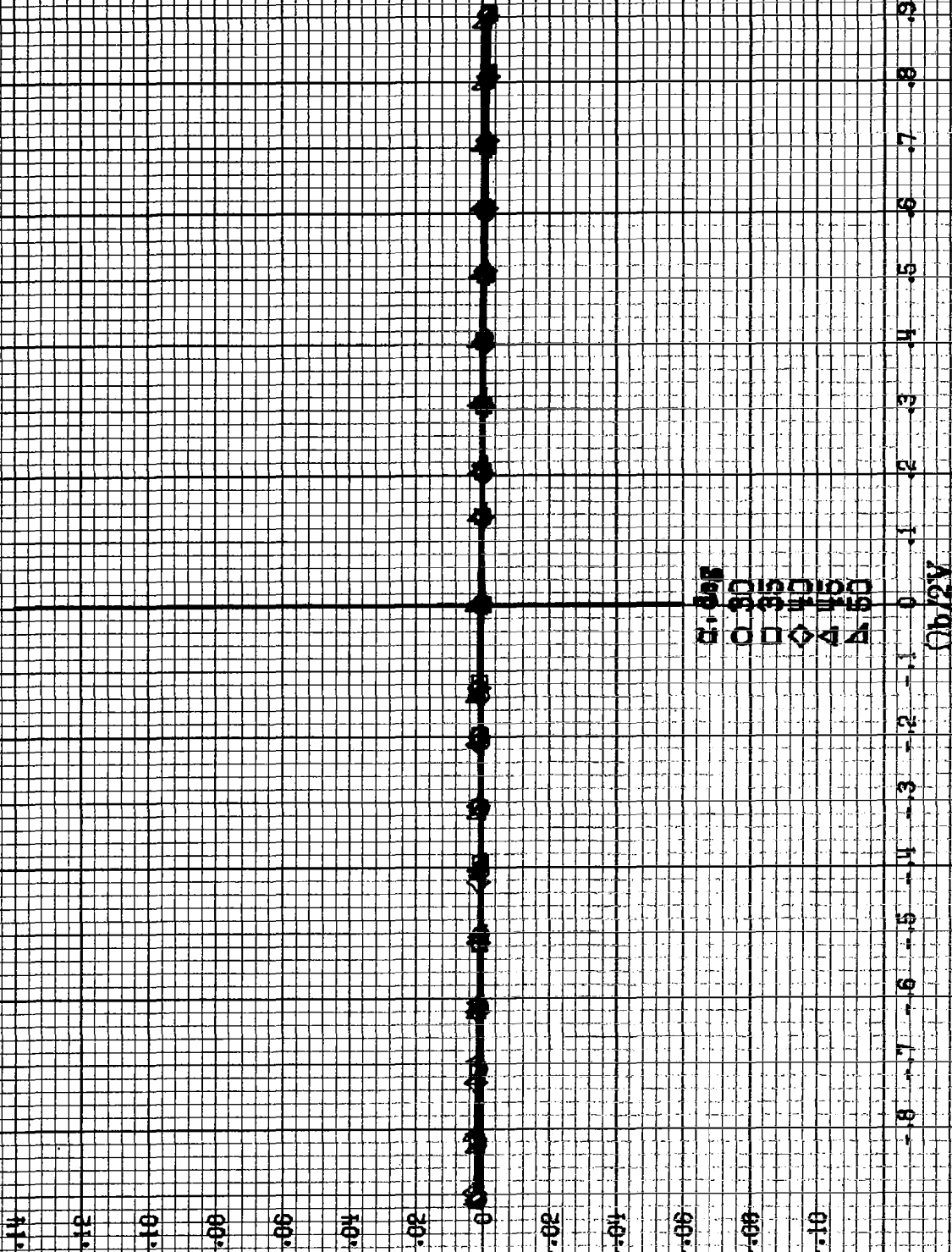
Figure A104.-Effect of rotation rate and angle of attack on rolling-moment coefficient for body alone configuration.  $\delta_a = 10^\circ$ ,  $\delta_r = 0^\circ$ ,  $\delta_s = 0^\circ$ ,  $\beta = 0^\circ$ .



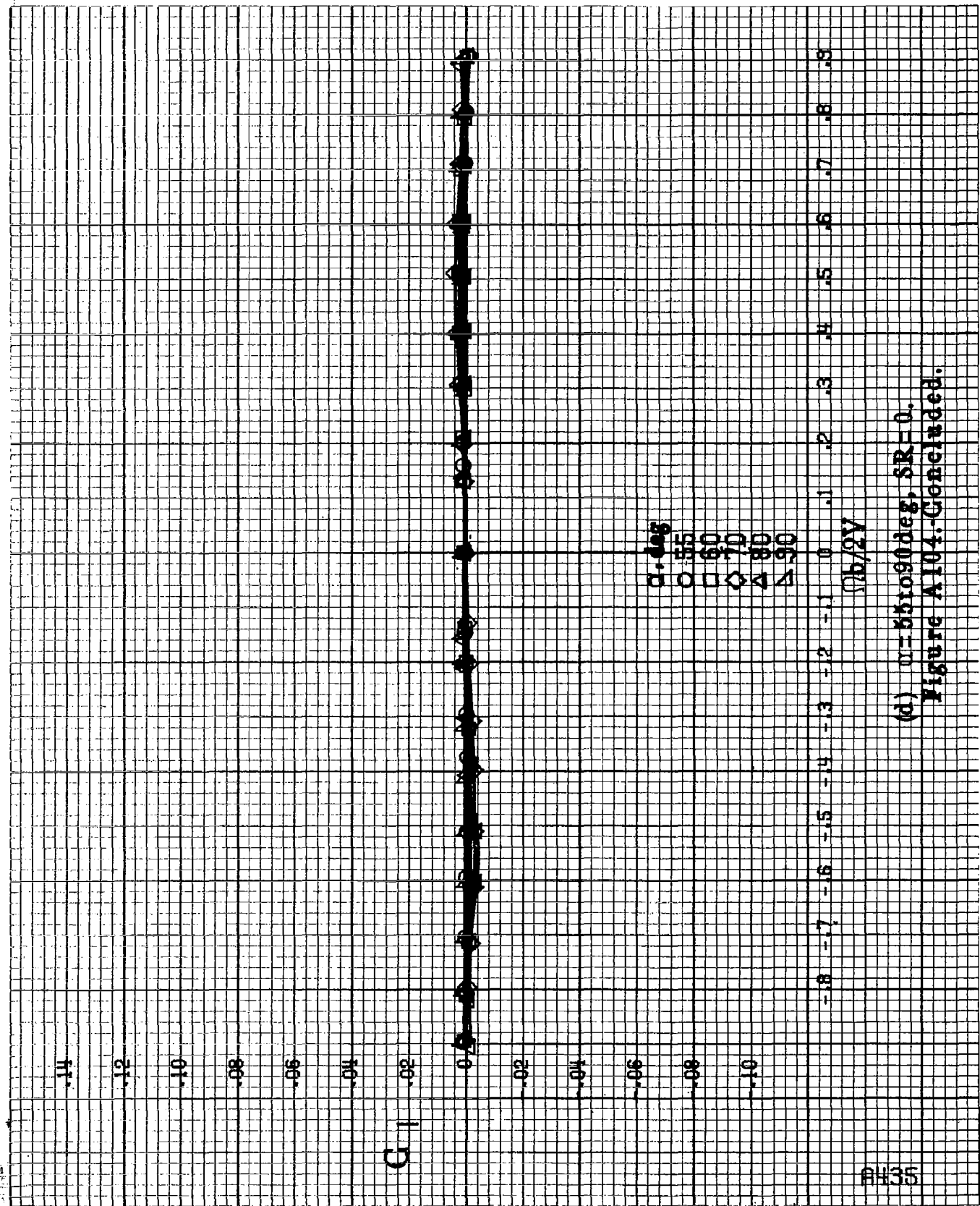
(b)  $\alpha = 18$  to  $35^\circ$ ,  $SR = 182.9 \text{ cm (72 in.)}$   
 Figure A104-Continued.

PH34

G



(a)  $\alpha = 80$  to  $60$  deg,  $SR = 0$ .  
Figure A104-Continued.



(d)  $\alpha = 85$  to  $90$  deg,  $SR = 0$ .  
Figure A104. Concluded.

8436

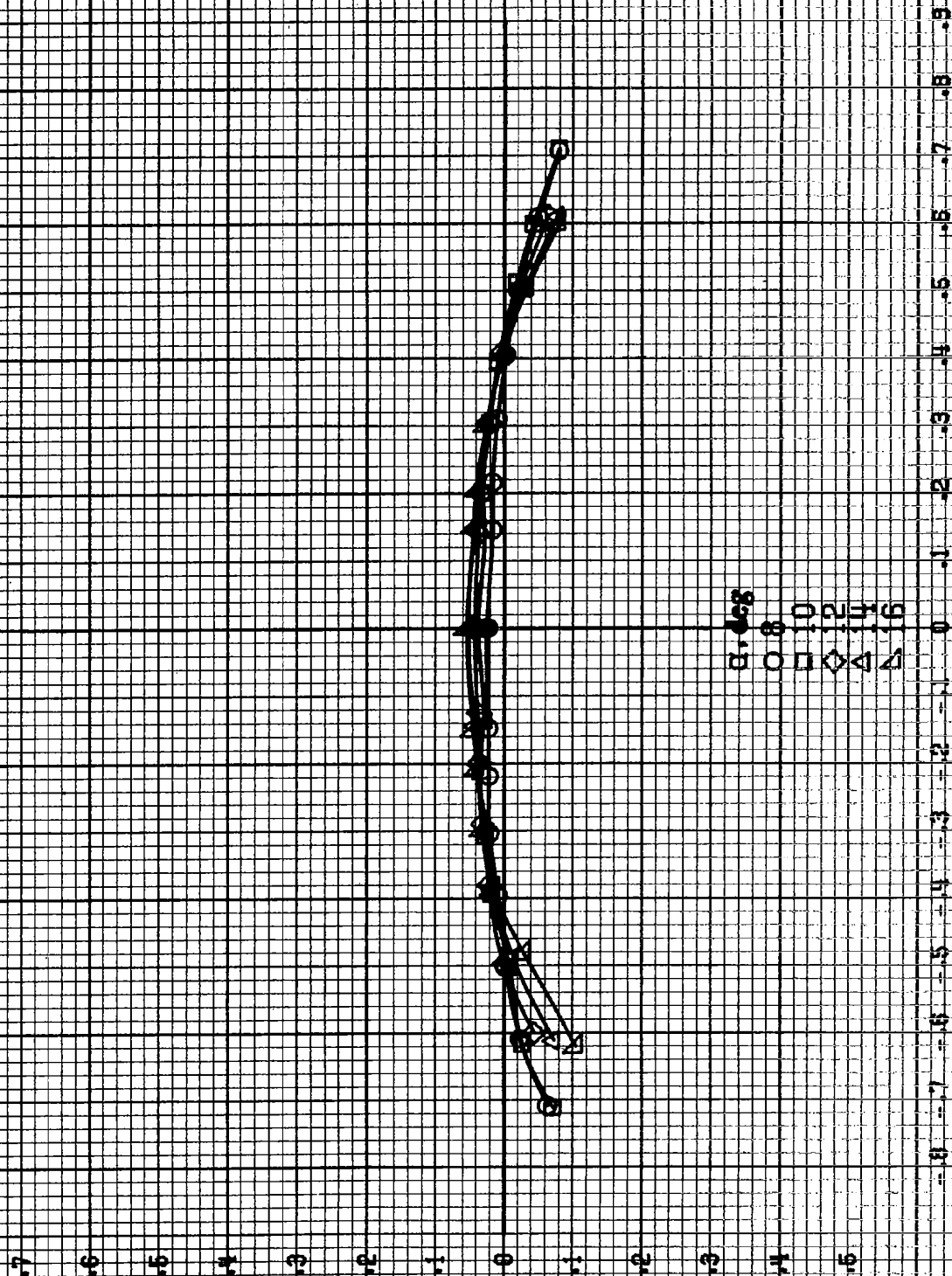
$C_m$

$\alpha, \text{deg}$   
 0 8  
 10  
 12  
 14  
 16

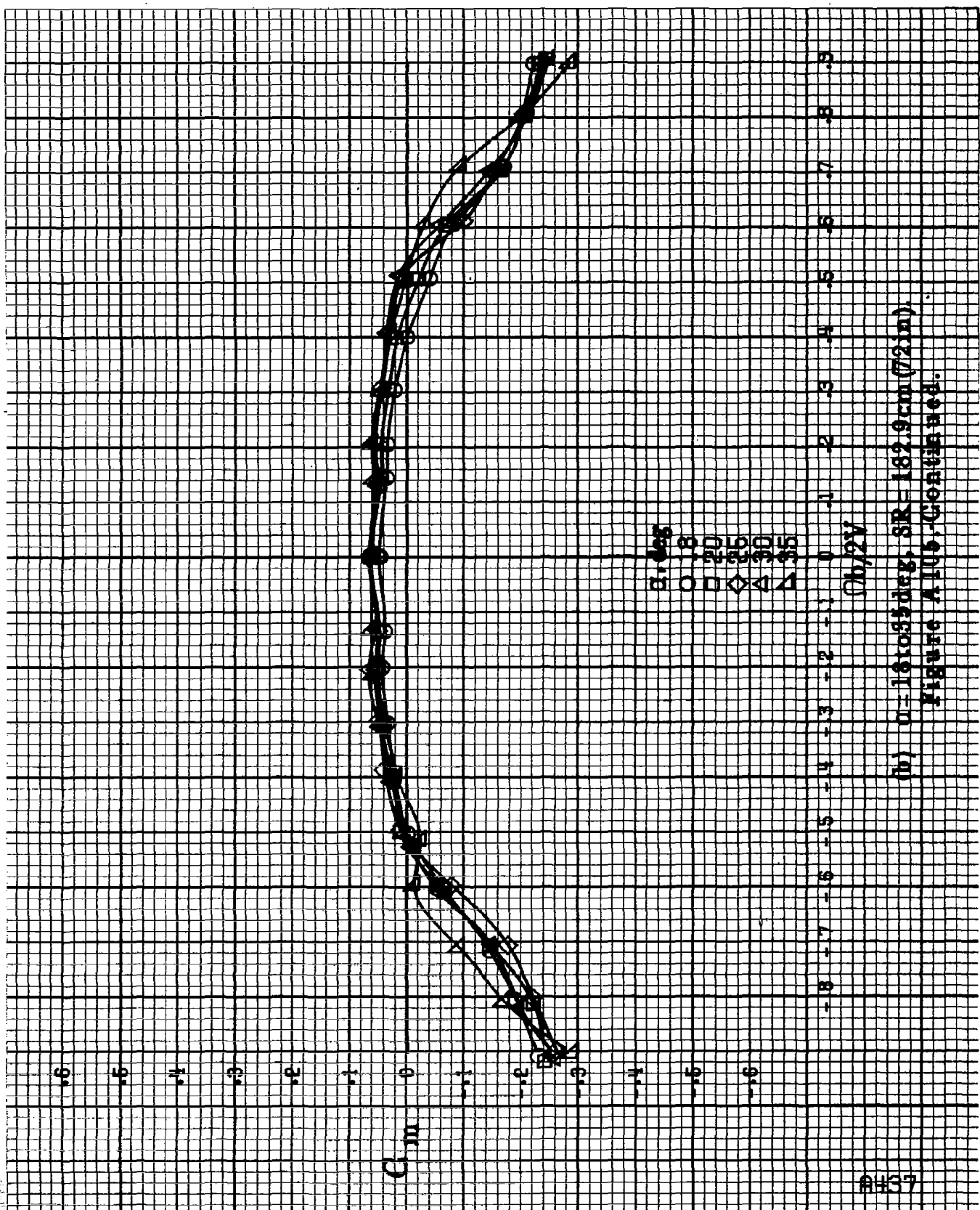
$\gamma/2^\circ$

(a)  $\alpha = 8 \pm 16 \text{ deg}$ ,  $SR = 132.9 \text{ cm} (72 \text{ in})$ .

Figure A108.-Effect of rotation rate and angle of attack on pitch moment coefficient for body alone configuration.  $\delta_a = 10^\circ$ ,  $\delta_n = 3^\circ$ ,  $\delta_r = 0^\circ$ .





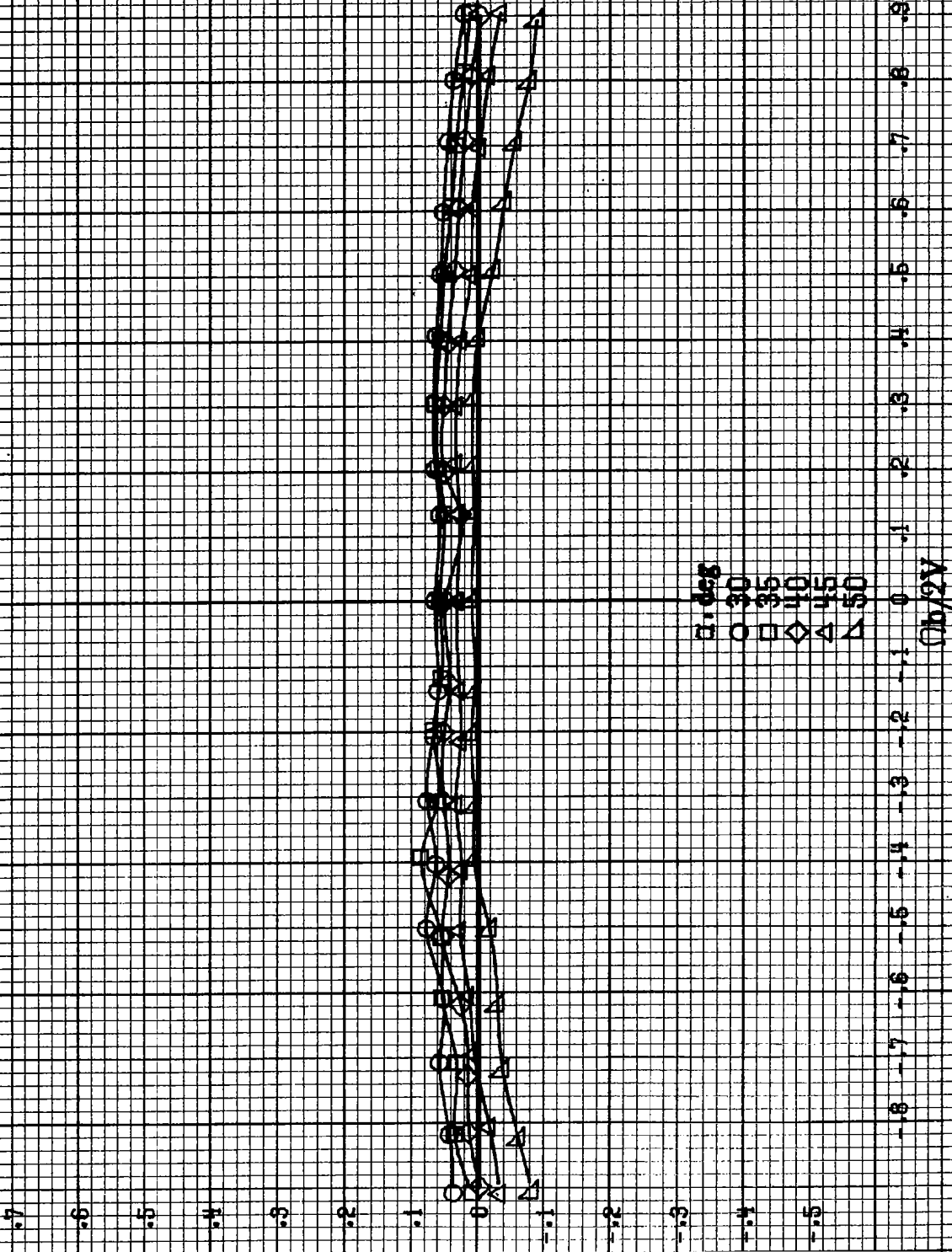


(b)  $\alpha = 15$  to  $35^\circ$ ,  $SR = 182.9 \text{ cm} (72 \text{ in})$

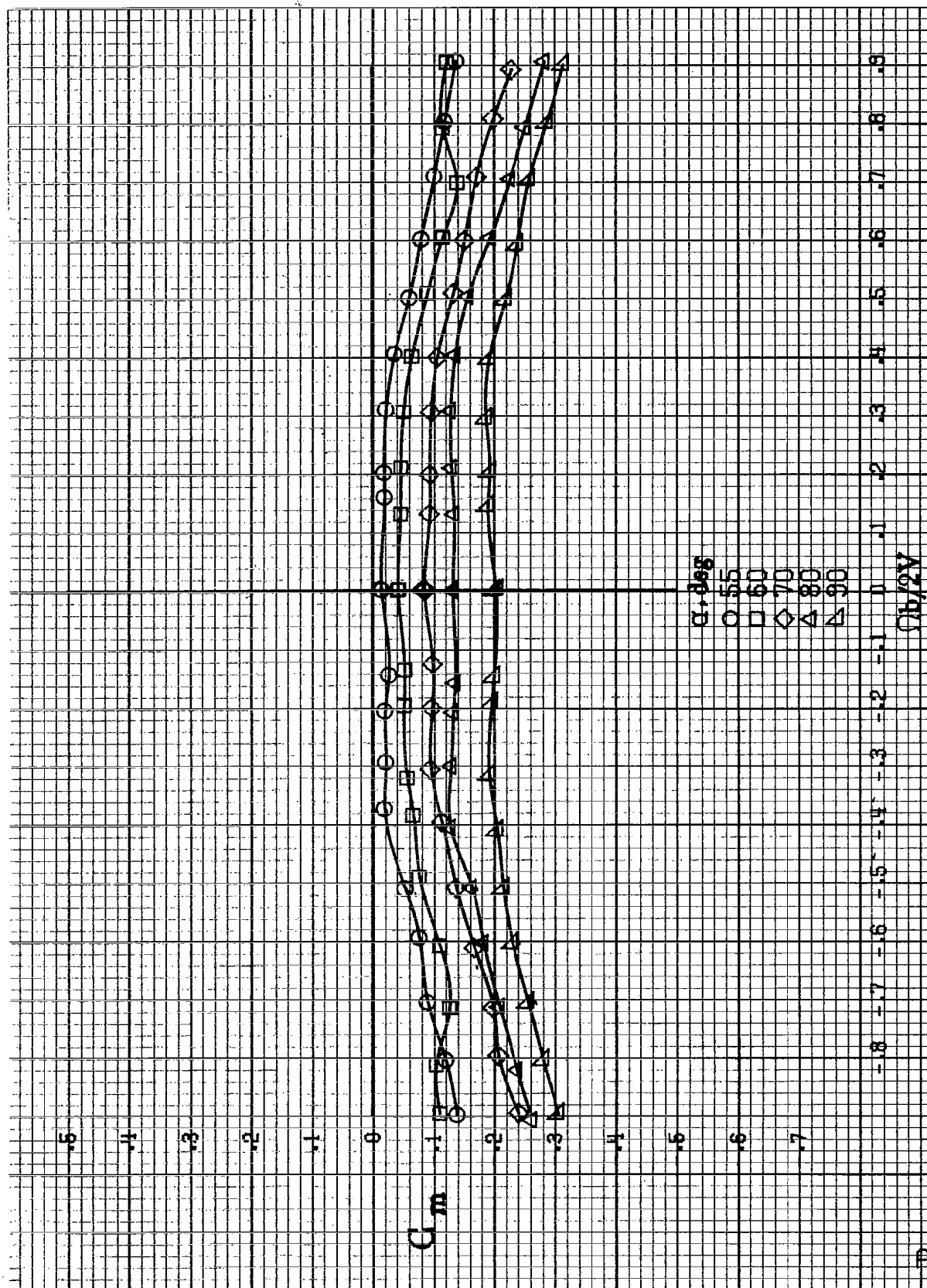
Figure A10b-Continued.

#438

$C_m$



(c)  $\alpha = 30$  to  $50^\circ$ ,  $SR = 0$ .  
Figure A105-Continued.



(d)  $\Omega = 55$  to  $90^\circ$ ,  $SR=0$ .  
Figure A105.-Concluded.

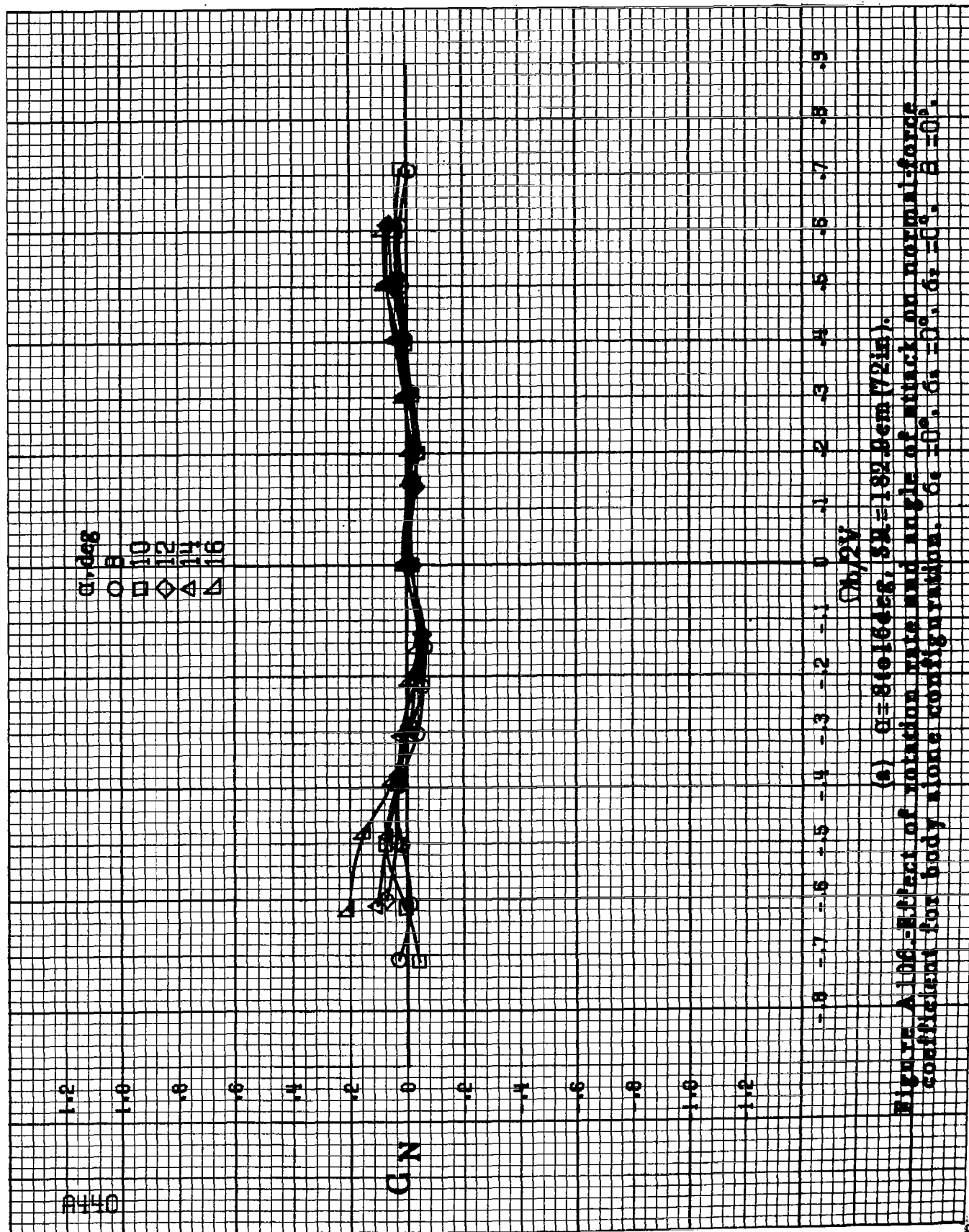
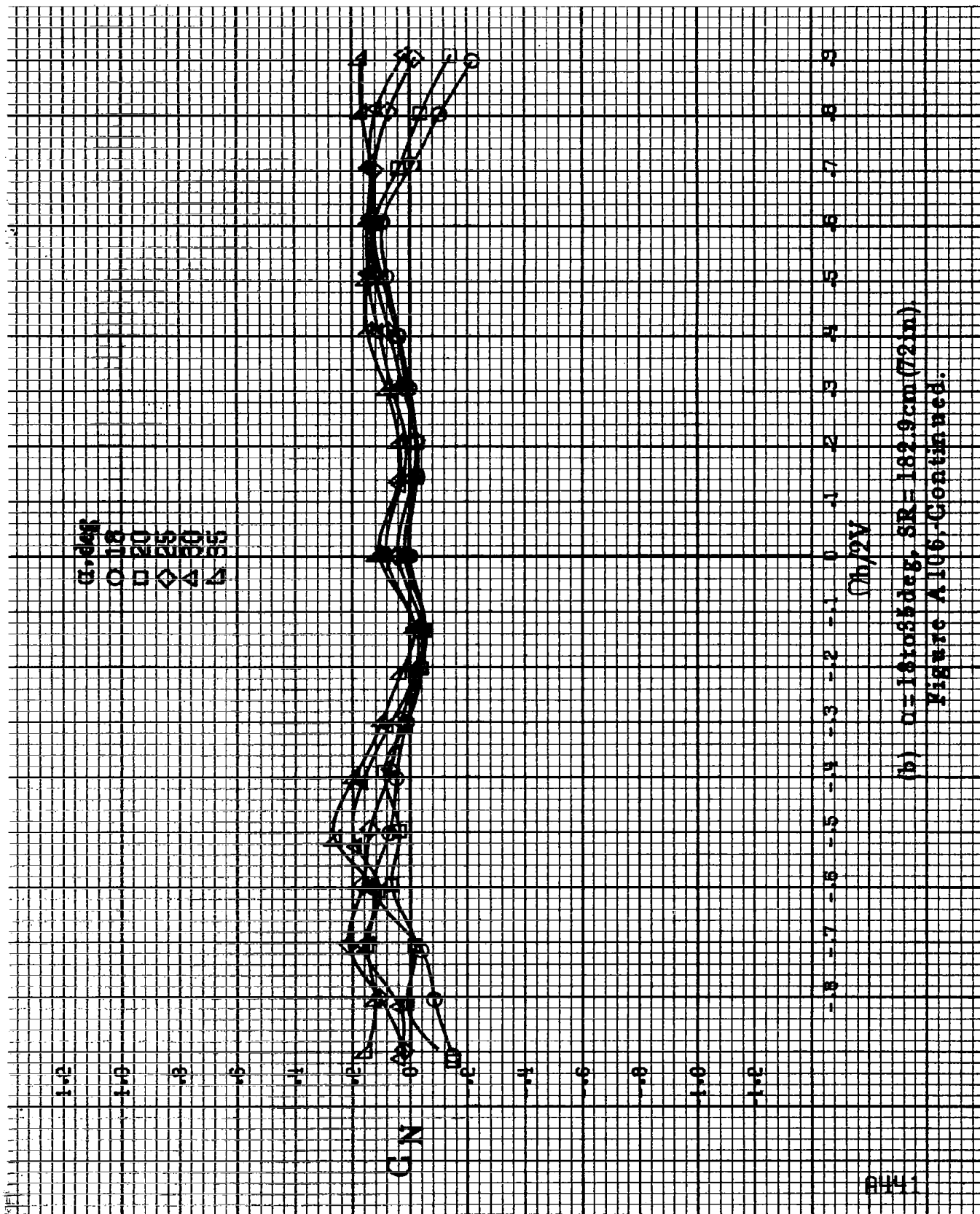


Figure A.106-Effect of rotation rate and angle of attack on normal force coefficient for body alone configuration.  $\alpha = 8^\circ, 10^\circ, 12^\circ, 14^\circ, 16^\circ$ .  $Re = 1.82 \times 10^6$ .



(b)  $\alpha = 18$  to  $55^\circ$ ,  $SR = 162.9 \text{ cm (72 in)}$ .  
Figure A106, Continued.

442

1.4

1.2

1.0

.8

.6

.4

.2

0

-.2

-.4

-.6

-.8

-1.0

$\alpha$ , deg

30

35

40

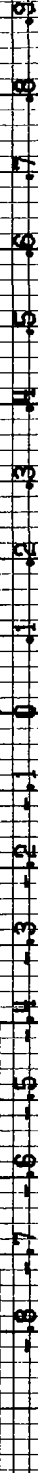
45

50

CN

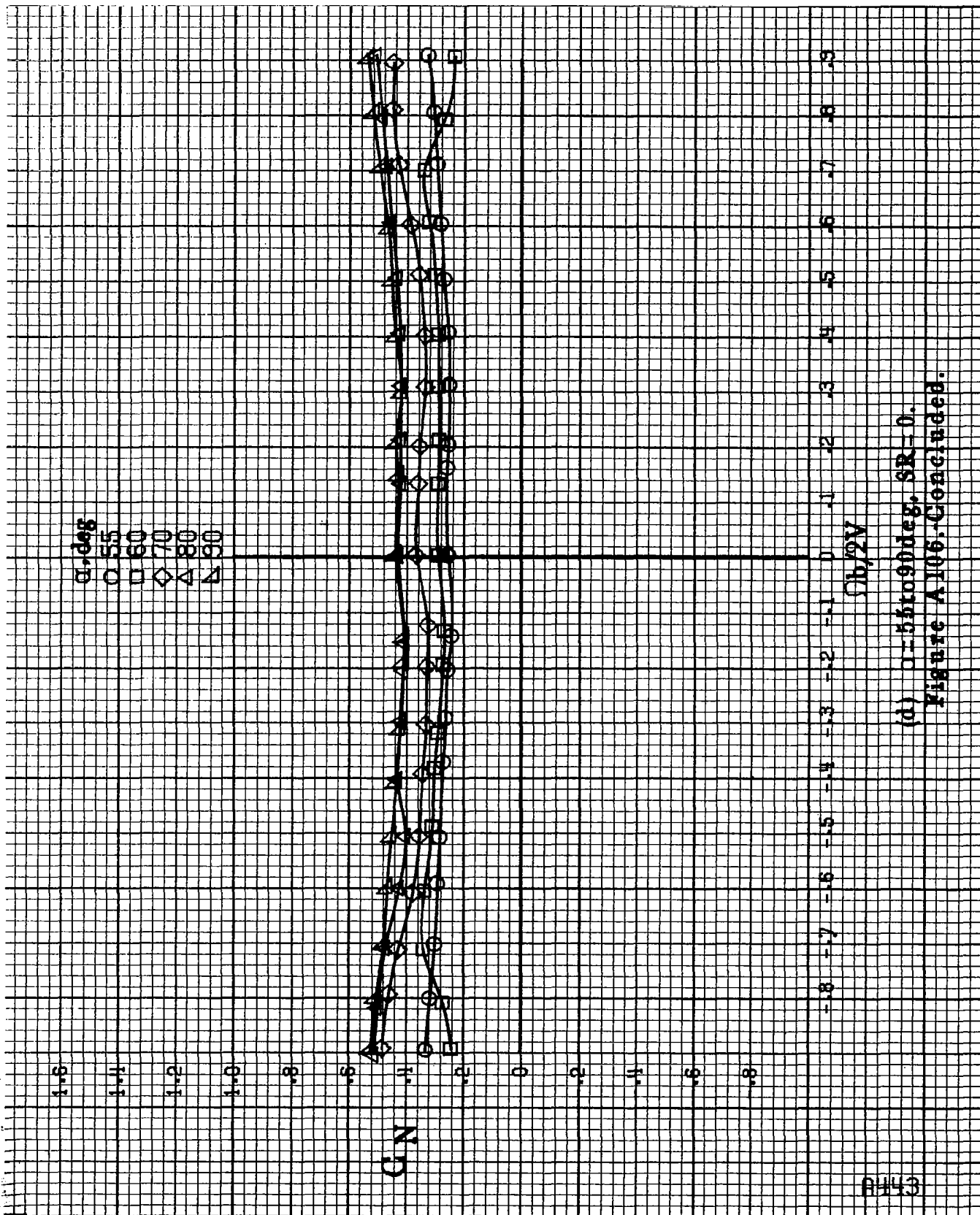


$Cb/2V$



(c)  $N=30$  to  $50$  deg,  $SR=0$ .

Figure A106, Continued.



(d)  $\alpha = 55$  to  $90$  deg,  $SR = 0$ .  
Figure A106. Concluded.

0.144

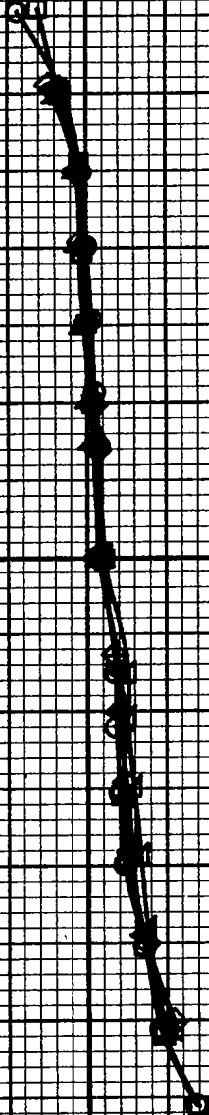
0.08  
0.10  
0.12  
0.14  
0.16

Cy

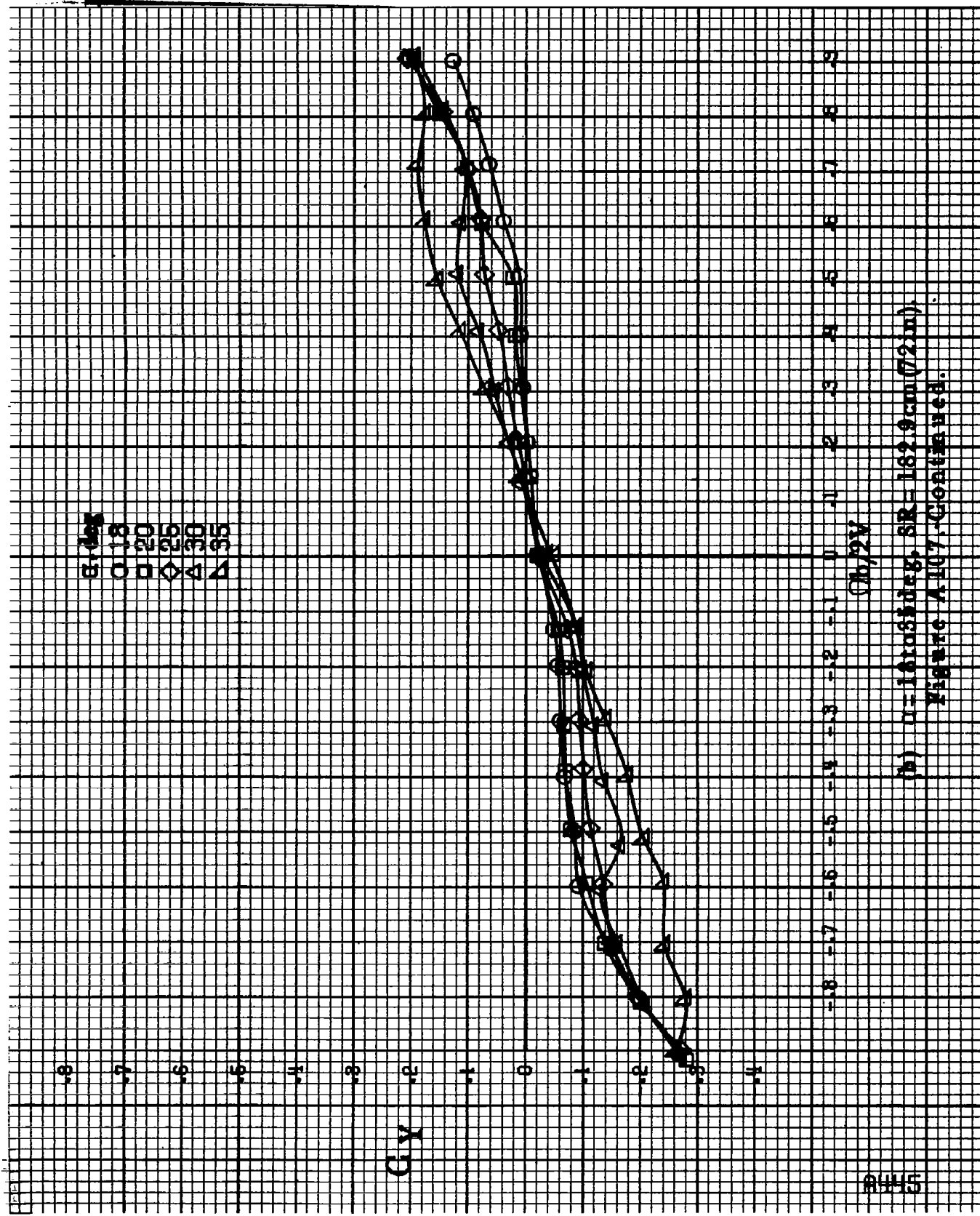
0.02V

(a)  $\alpha = 8$  to  $18$  deg,  $SX = 182.9$  cm (72 in).

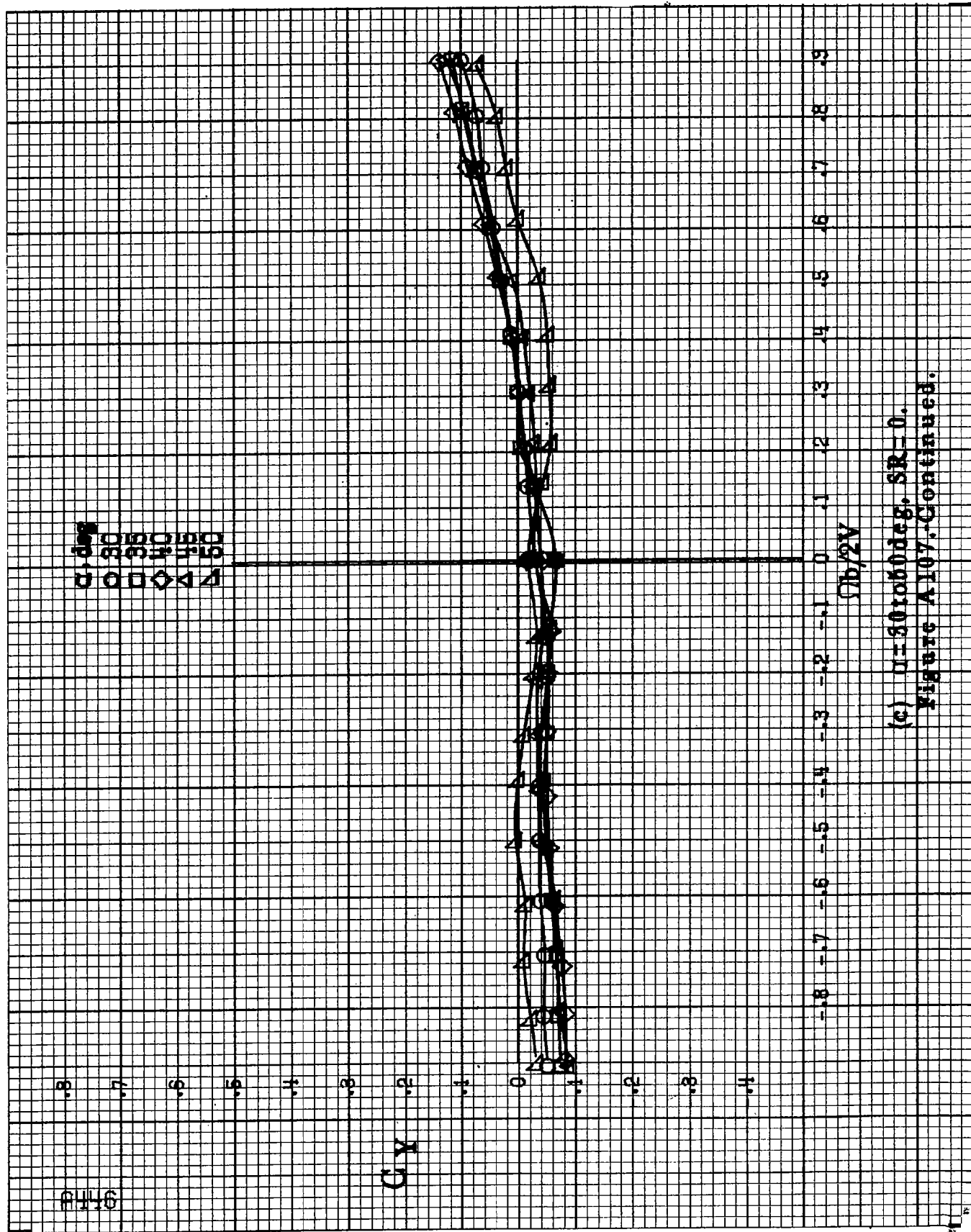
Figure A107.-Effect of rotation rate and angle of attack on sideforce coefficient for body alone configuration.  $\delta_a \cdot 10^3$ ,  $\delta_a \pm 0^\circ$ ,  $\delta_a \pm 10^\circ$ .



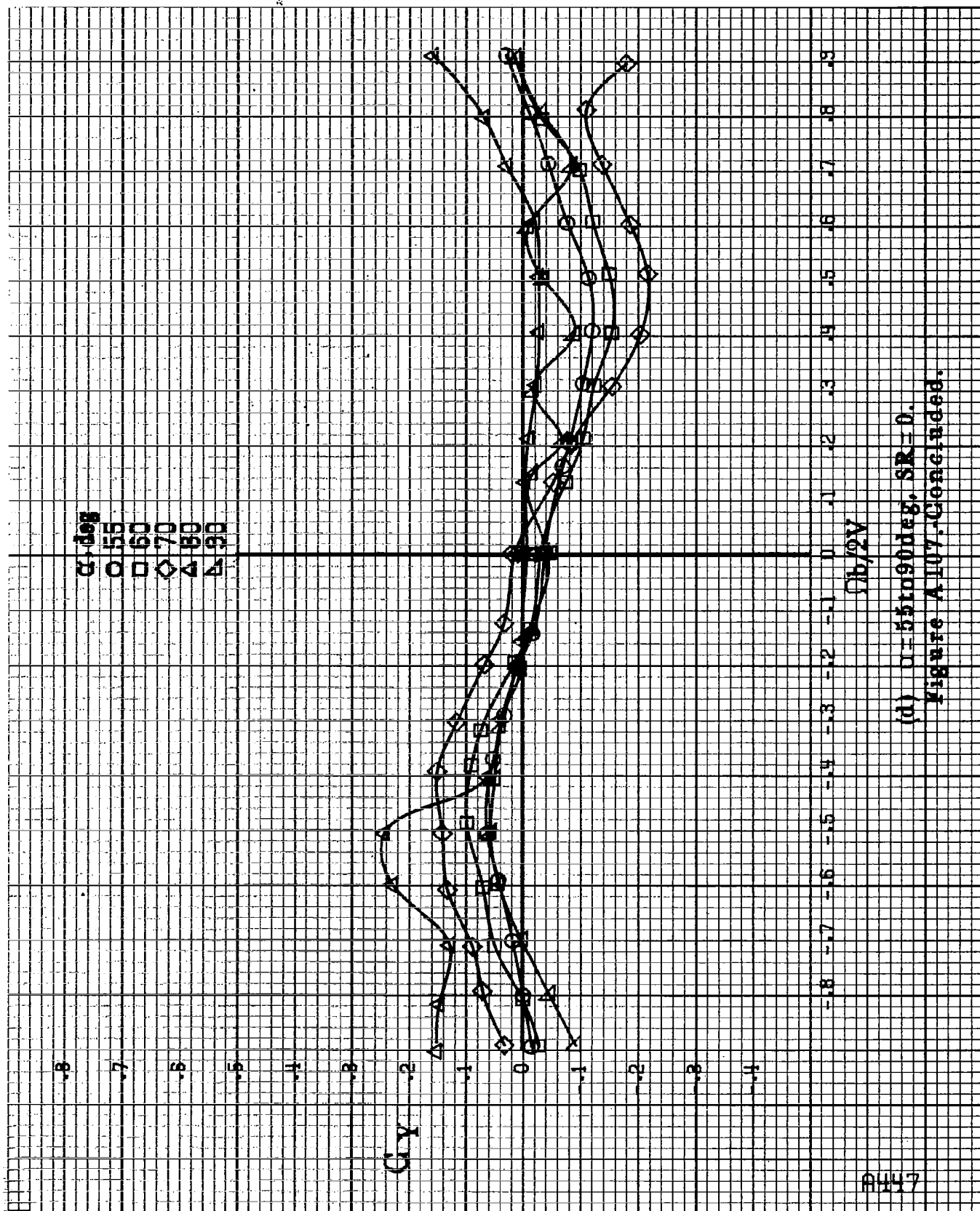




(b)  $a=1.6$  to  $3.5$  in  $0.5$ ,  $SR=162.9$  cm (72 in).  
Figure A107. Continued.



(c)  $\alpha = 0.05$  to  $0.9$ ,  $SR = 0$ .  
Figure A107. Continued.



(d)  $u=55$  to  $90^\circ$ ,  $SR=0$ .  
Figure A107-Concluded.

8448

51 deg

0.8

1.0

1.2

1.4

1.6

DA

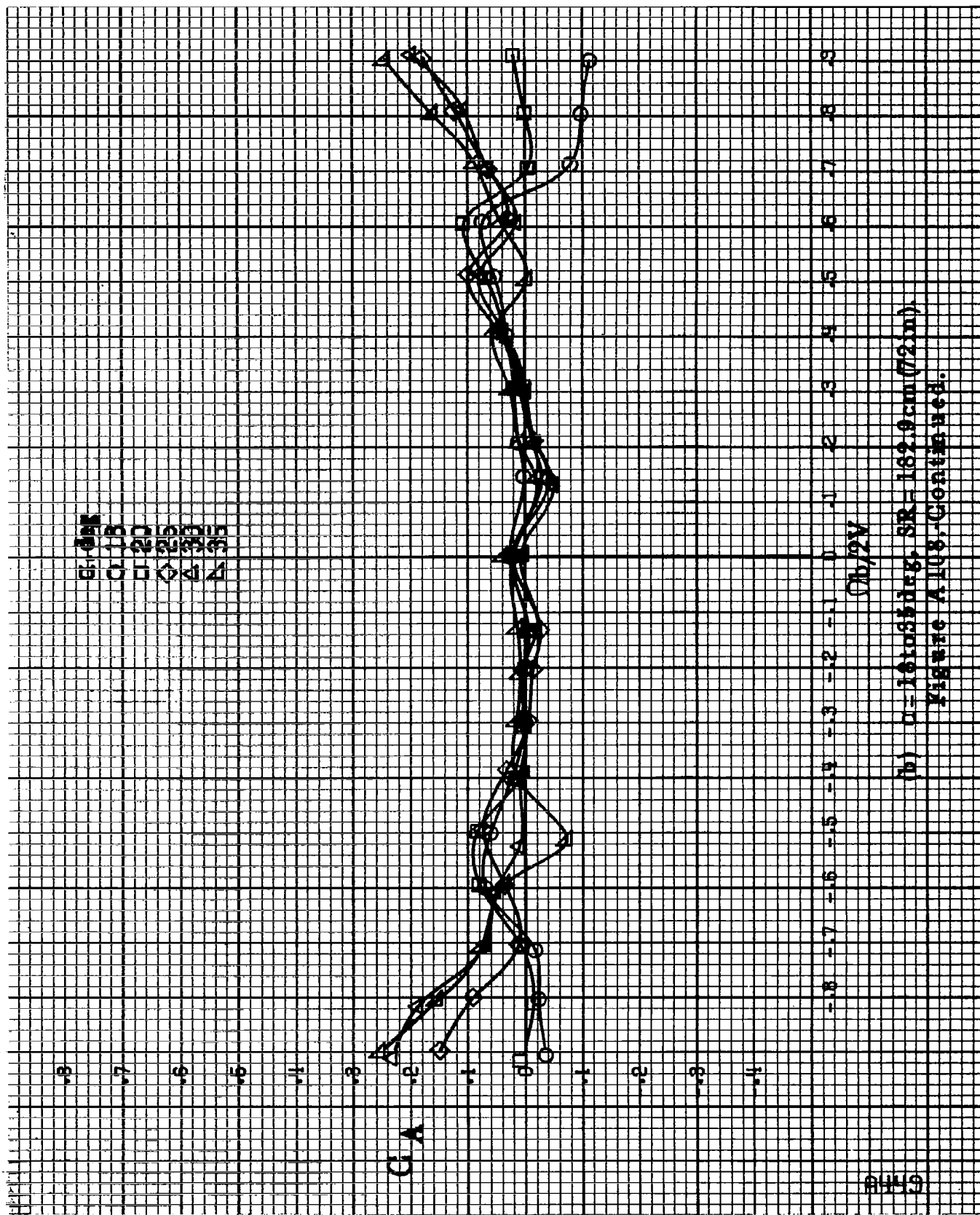


-0.8 -0.7 -0.6 -0.5 -0.4 -0.3 -0.2 -0.1 0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9

$\alpha/2$

(a)  $\alpha = 8$  to  $16$  deg,  $SR = 132$  sem (72 in).

Figure A106.-Effect of rotation rate and angle of attack on axial-force coefficient for body alone configuration.  $\alpha = 10^\circ$ ,  $\alpha_1 = 0^\circ$ ,  $\alpha_2 = 0^\circ$ ,  $\beta = 0^\circ$ .



(b)  $\mu = 161036 \text{ kg}$ ,  $SR = 162.9 \text{ cm (72 in)}$   
 Figure A108-Continued.

8450

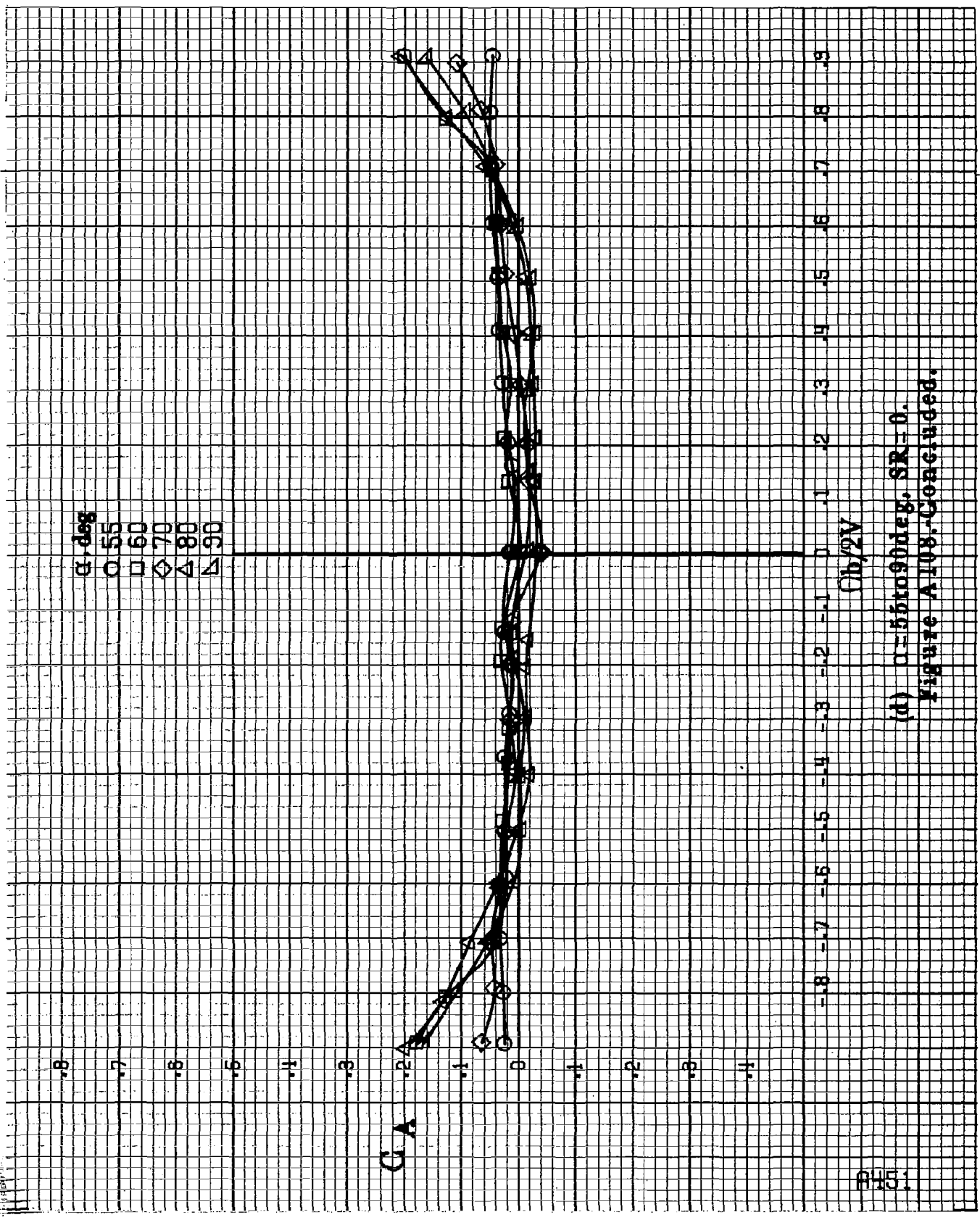
$\alpha$ , deg  
 ○ 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▽ 50

$C_A$

$C_b/2V$

(c)  $\alpha = 30$  to  $50$  deg,  $SR = 0$ .  
 Figure A108, Continued.





(d)  $\alpha = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A108-Concluded.

4452

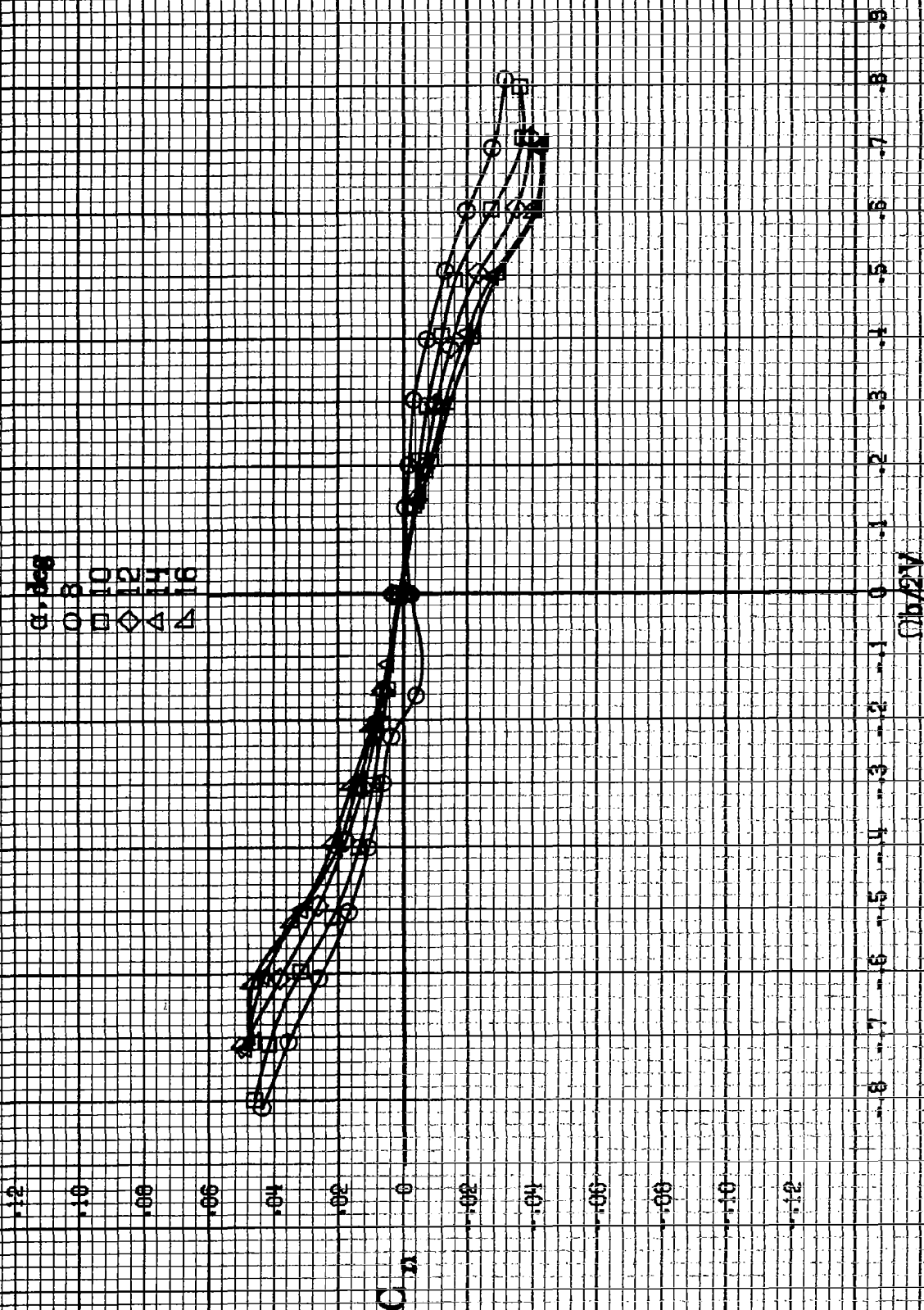
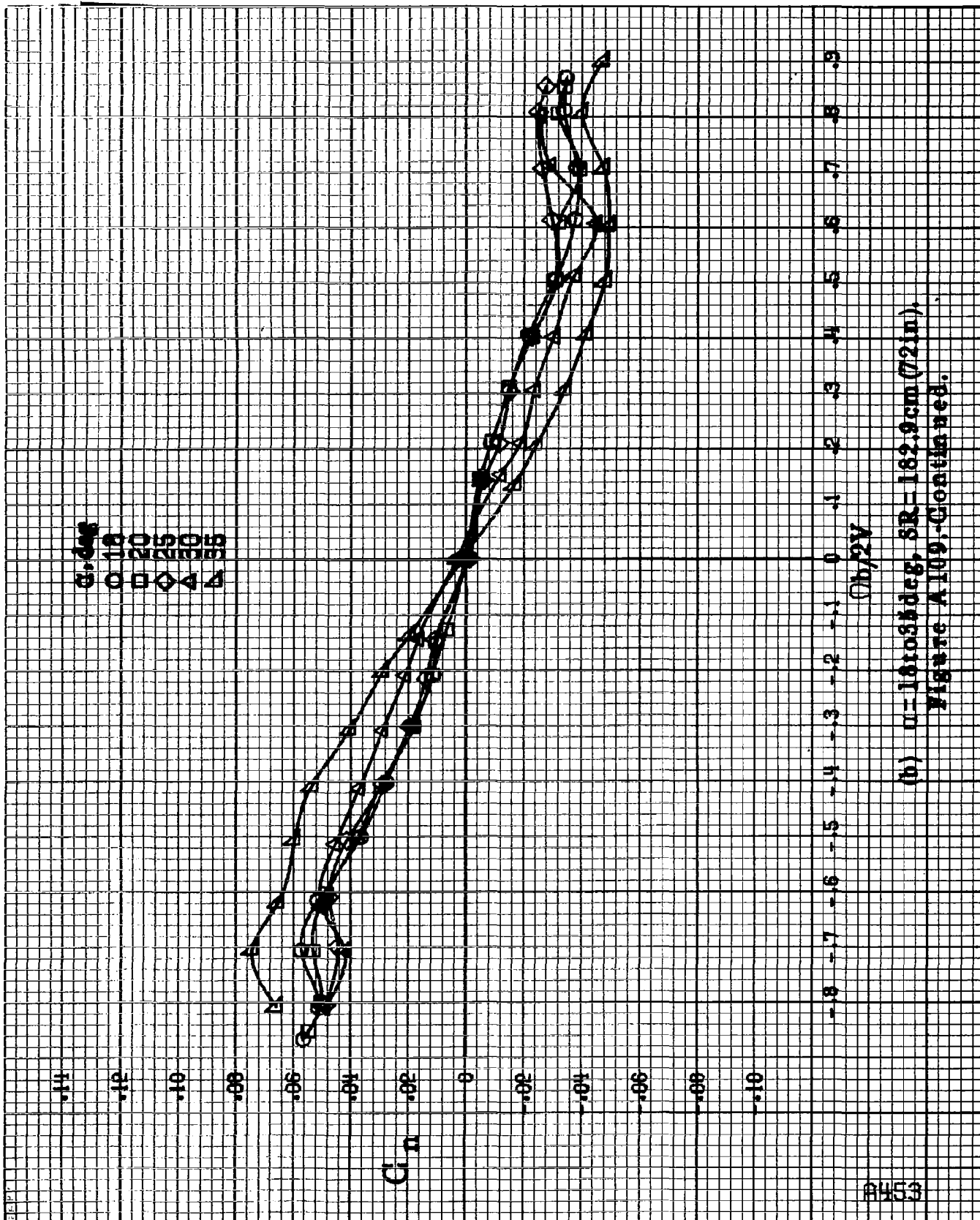


Figure 109.-Effect of rotation rate and angle of attack on yawing-moment coefficient for wing off configuration.  $\alpha=8^\circ, 10^\circ, 12^\circ, 14^\circ, 16^\circ$ .  $SR=182.6 \text{ cm}^2/2 \text{ in}^2$ .





(b)  $\alpha = 1810.35 \text{ deg}$ ,  $SR = 162.9 \text{ cm (72 in)}$ ,  
Figure A109-Continued.

PH 154

.12

.10

.08

.06

.04

.02

0

.02

.04

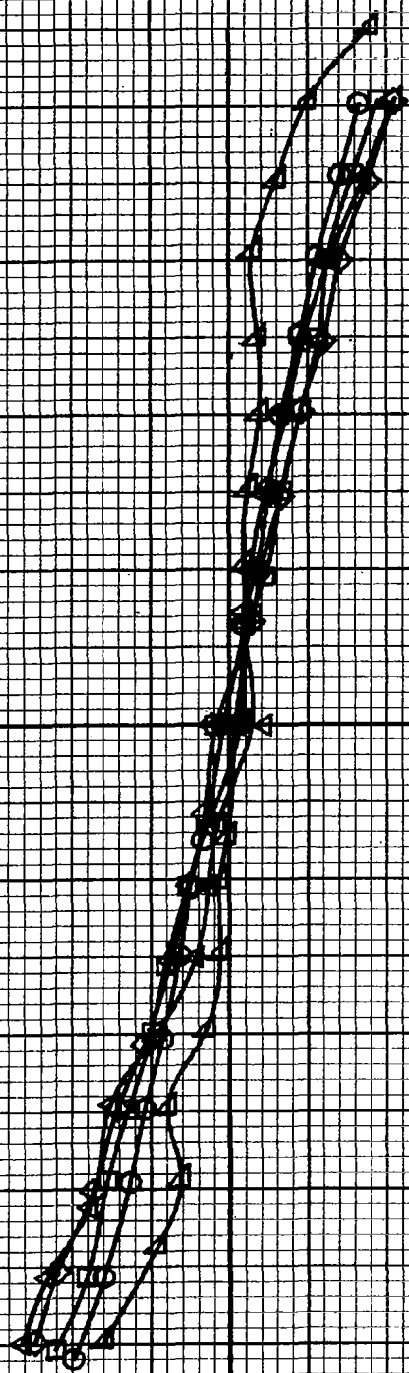
.06

.08

.10

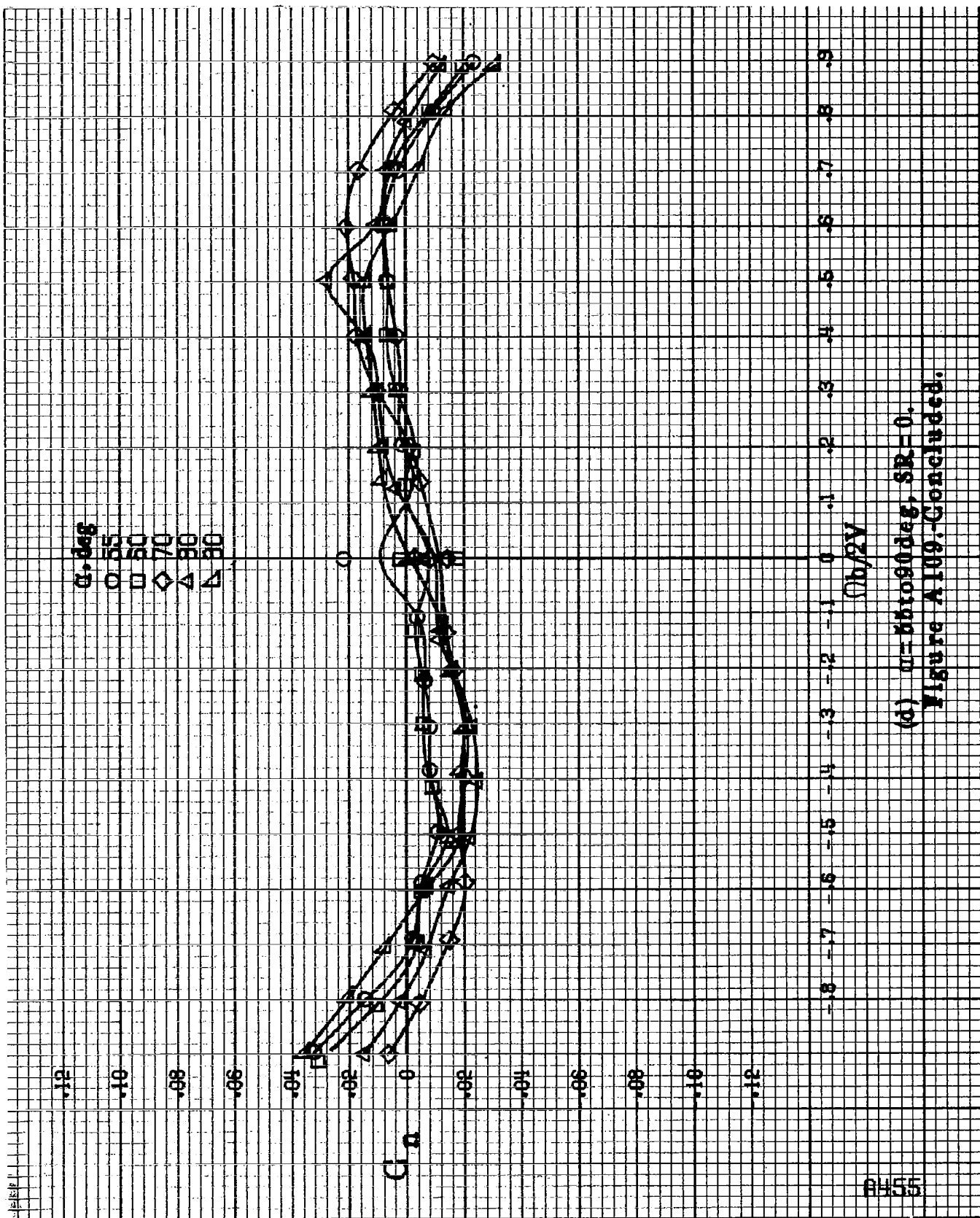
.12

$\Delta$  100  
 $\square$  100  
 $\diamond$  100  
 $\circ$  100  
 $\times$  100  
 $\cdot$  100



$Oh/2V$

(c)  $m = 30$  to  $60$  deg,  $\delta E = 0$ .  
 Figure A109, Continued.



(d)  $\alpha = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A109-Concluded.

B456

$C_l$

.14  
.12  
.10  
.08  
.06  
.04  
0  
-.02  
-.04  
-.06  
-.08  
-.10

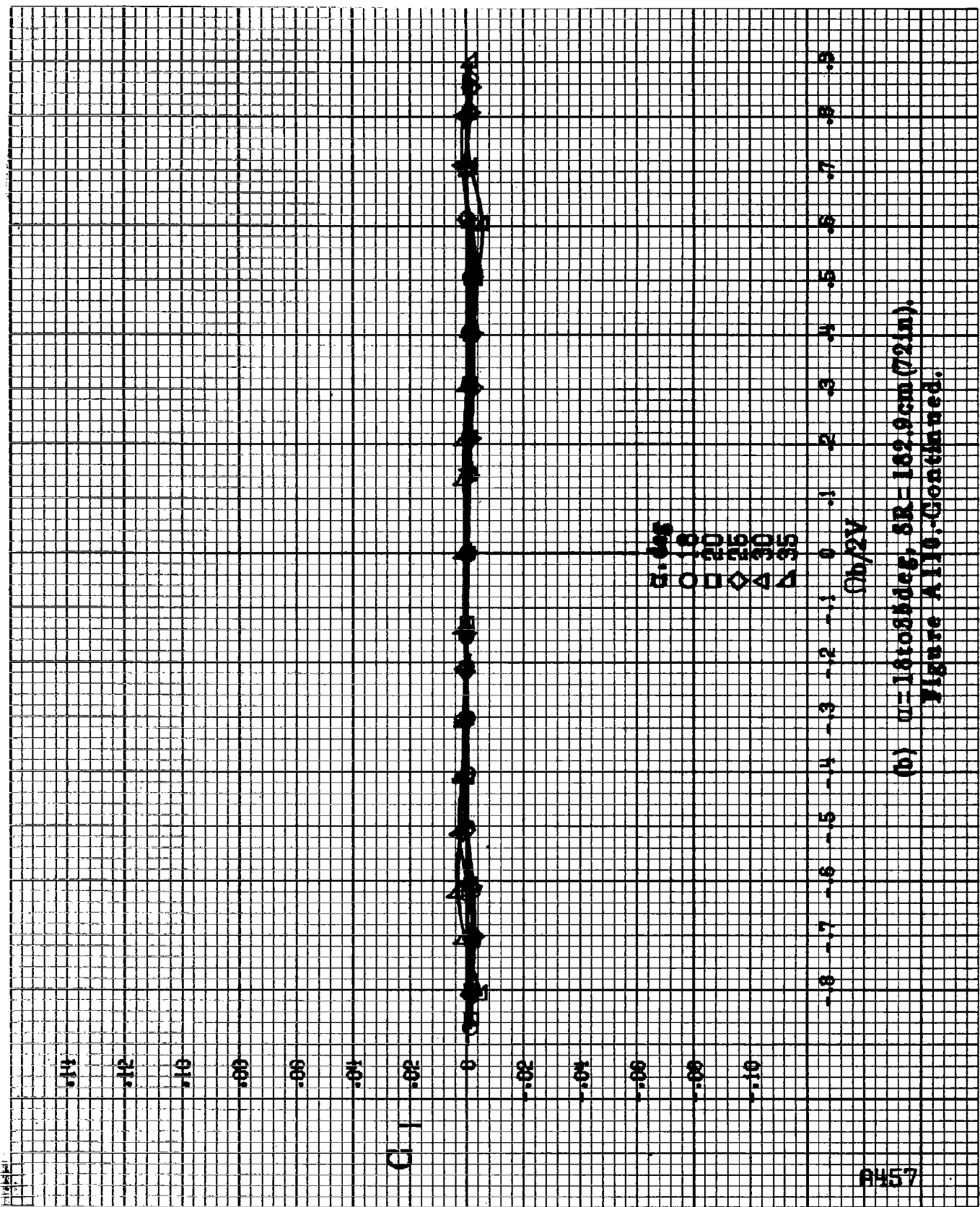
.8 .7 .6 .5 .4 .3 .2 .1 0 .1 .2 .3 .4 .5 .6 .7 .8

$Mb/2V$

$\alpha, \text{deg}$   
○ 8  
□ 10  
◇ 12  
△ 14  
▽ 16

(a)  $\alpha = 8 \text{ to } 16 \text{ deg}$ ,  $\delta R = 162.3 \text{ cm (72 in)}$ .

Figure A.110. Effect of rotation rate and angle of attack on rolling-moment coefficient for wing off configuration.  $\delta_a = 0^\circ$ ,  $\delta_r = 0^\circ$ ,  $\beta = 0^\circ$ .



(b)  $\mu=181025deg$ ,  $SR=182.9cm(72in)$ .  
Figure A110-Continued.

9458

C

.14

.12

.10

.08

.06

.04

.02

0

-.02

-.04

-.06

-.08

-.10

$\alpha$ , deg

○ 30

□ 35

◇ 40

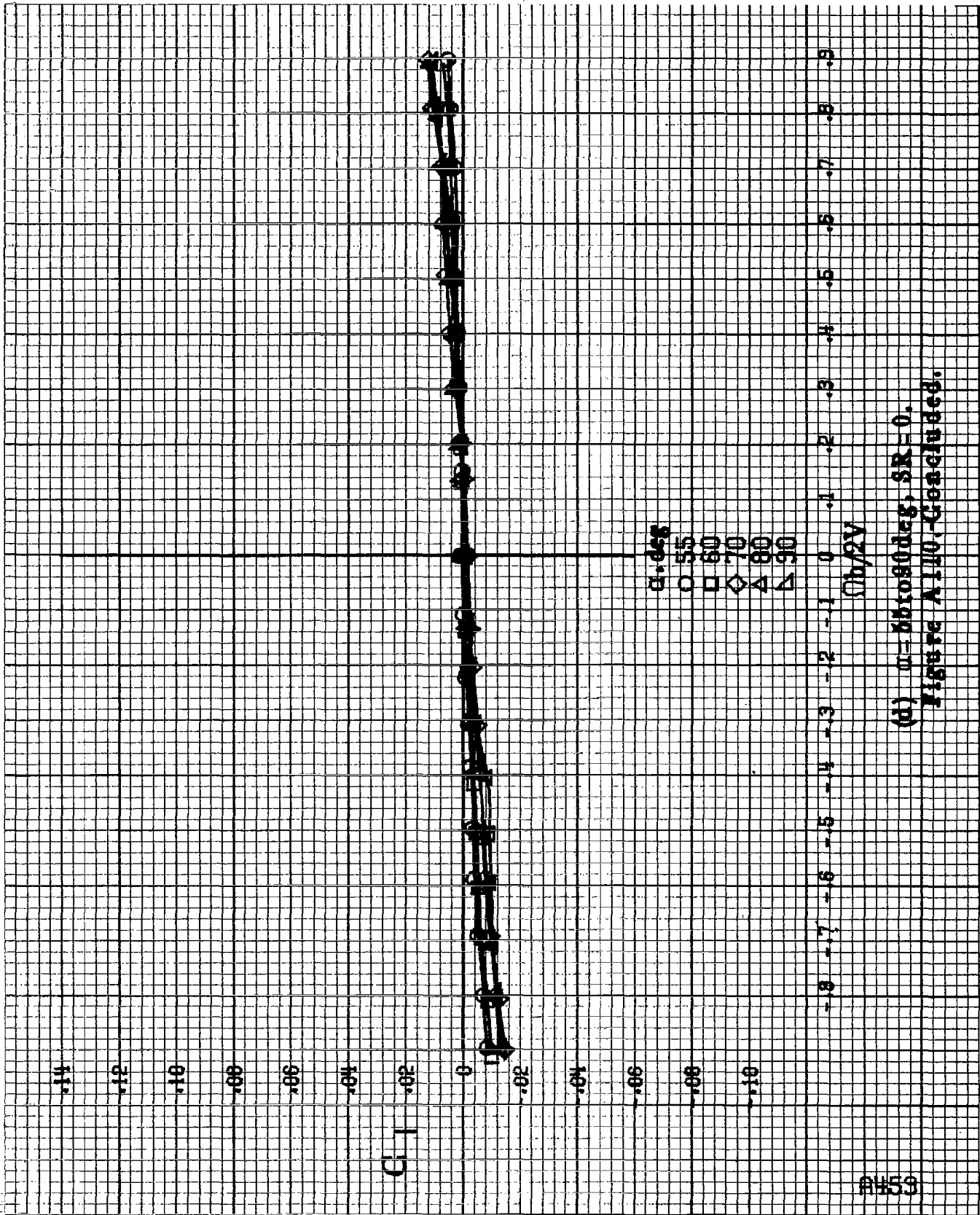
△ 45

▲ 50

$\Omega b/2V$

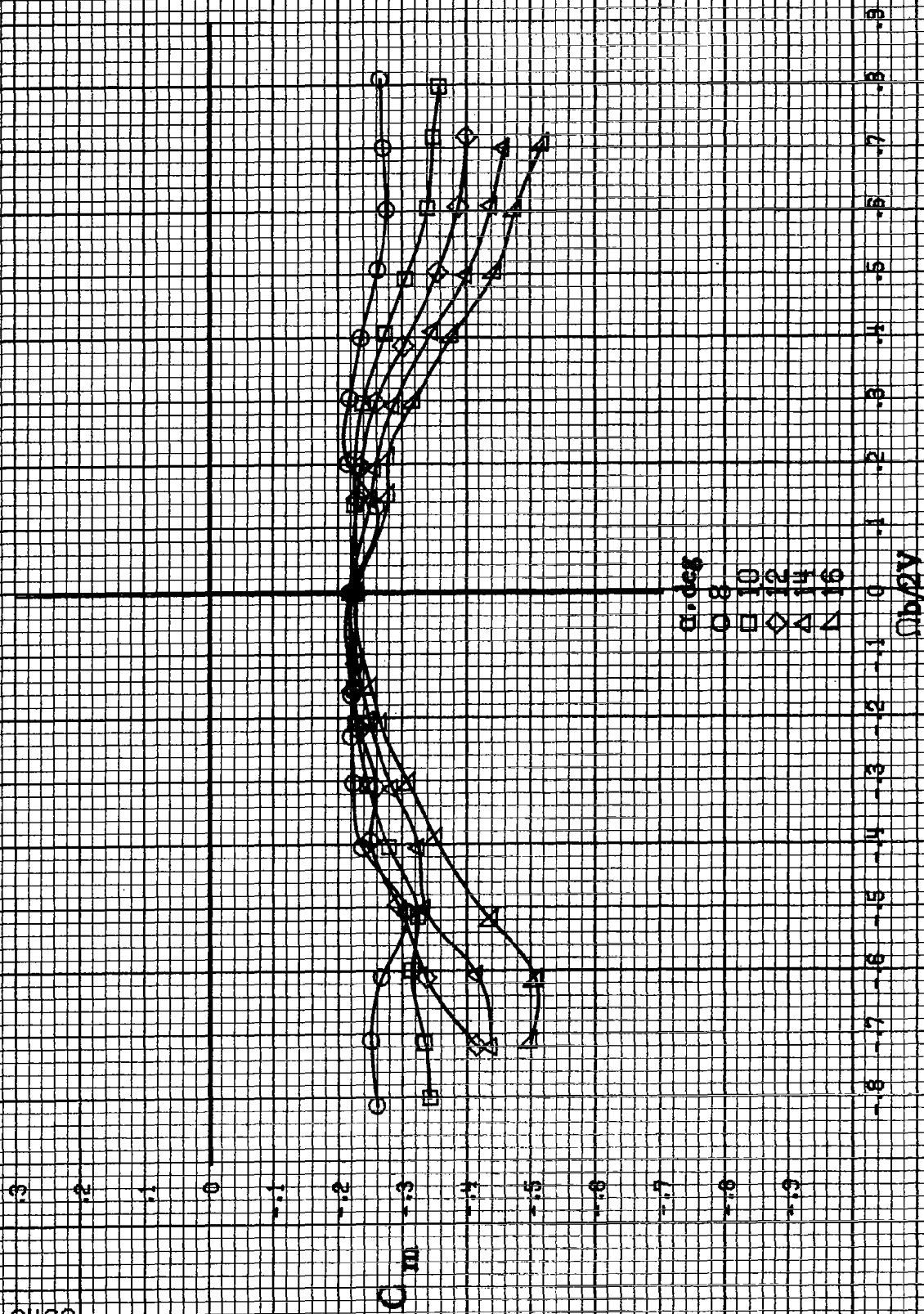
-.8 -.7 -.6 -.5 -.4 -.3 -.2 -.1 0 .1 .2 .3 .4 .5 .6 .7 .8 .9

(c)  $\alpha=30$  to  $50$  deg,  $SR=0$ ,  
Figure A110-Continued.



(d)  $\alpha = 55$  to  $90$  deg,  $SR = 0$ .  
Figure A110. Continued.

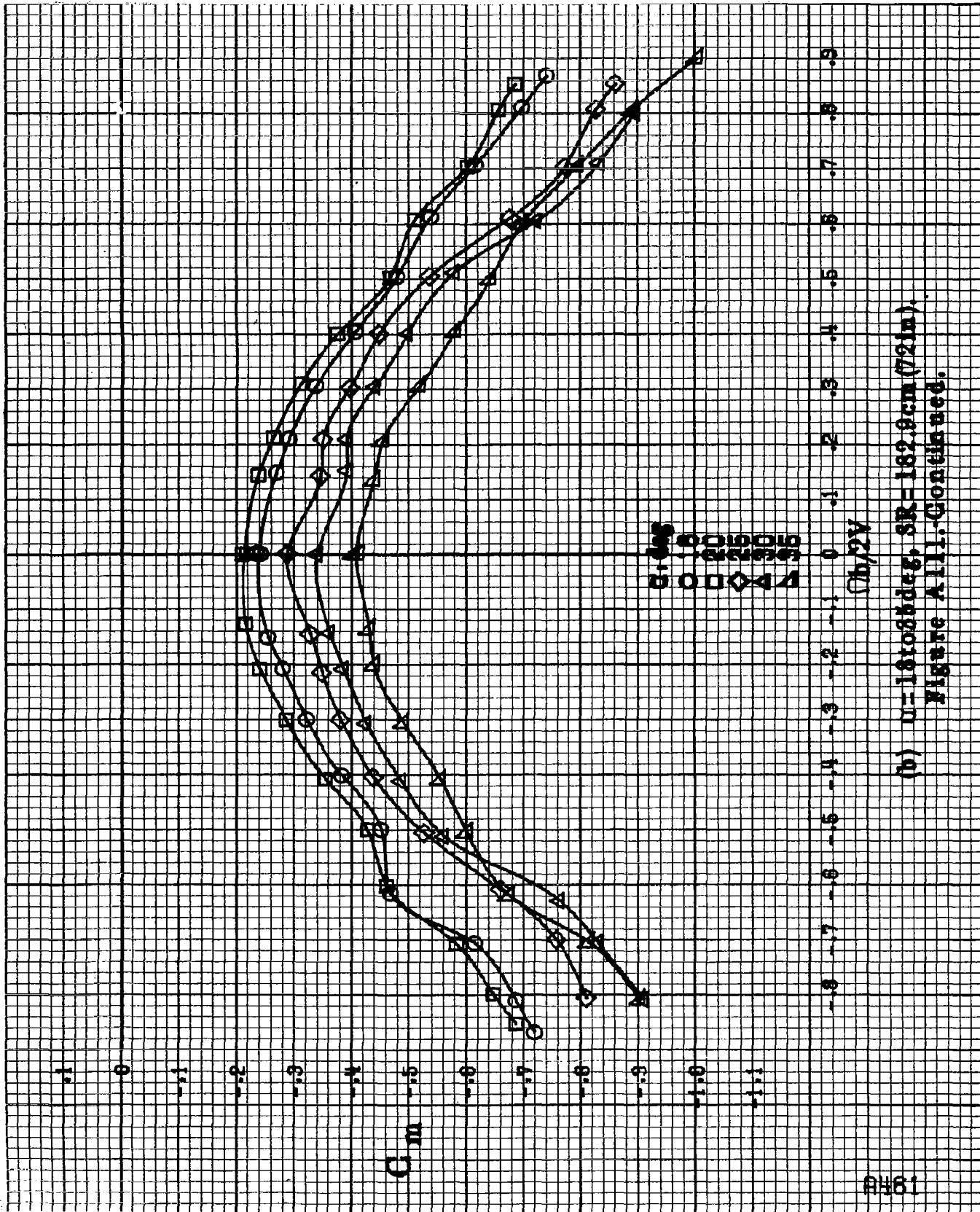
A460



(a)  $\alpha = 8$  to  $16$  deg,  $SR = 1.92$ ,  $Re = 7.2 \times 10^6$ .

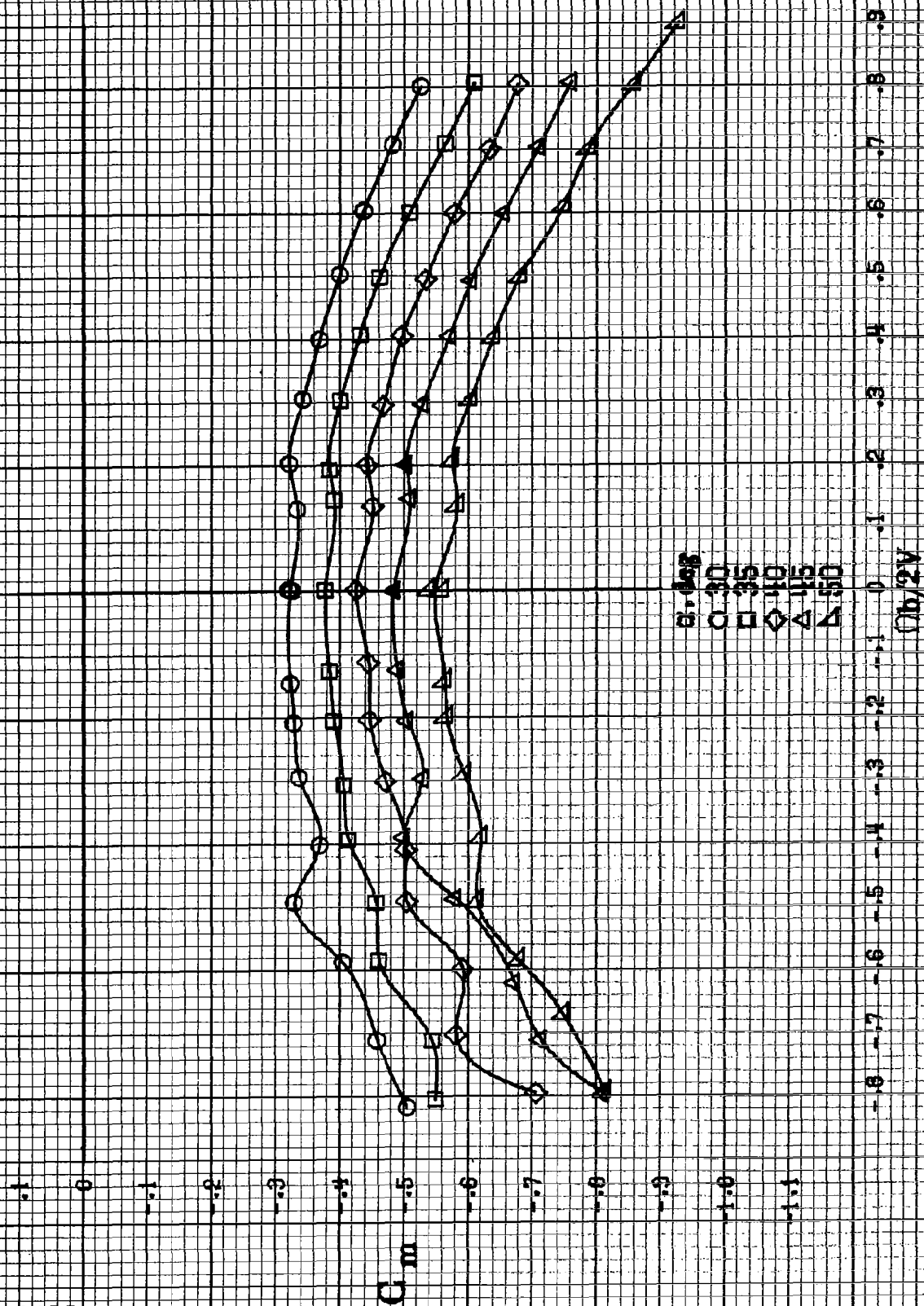
Figure A11.1. Effect of rotation rate and angle of attack on pitching-moment coefficient for wing off configuration.  $\delta_a = 10^\circ$ ,  $\delta_r = 10^\circ$ ,  $\delta_s = 10^\circ$ .



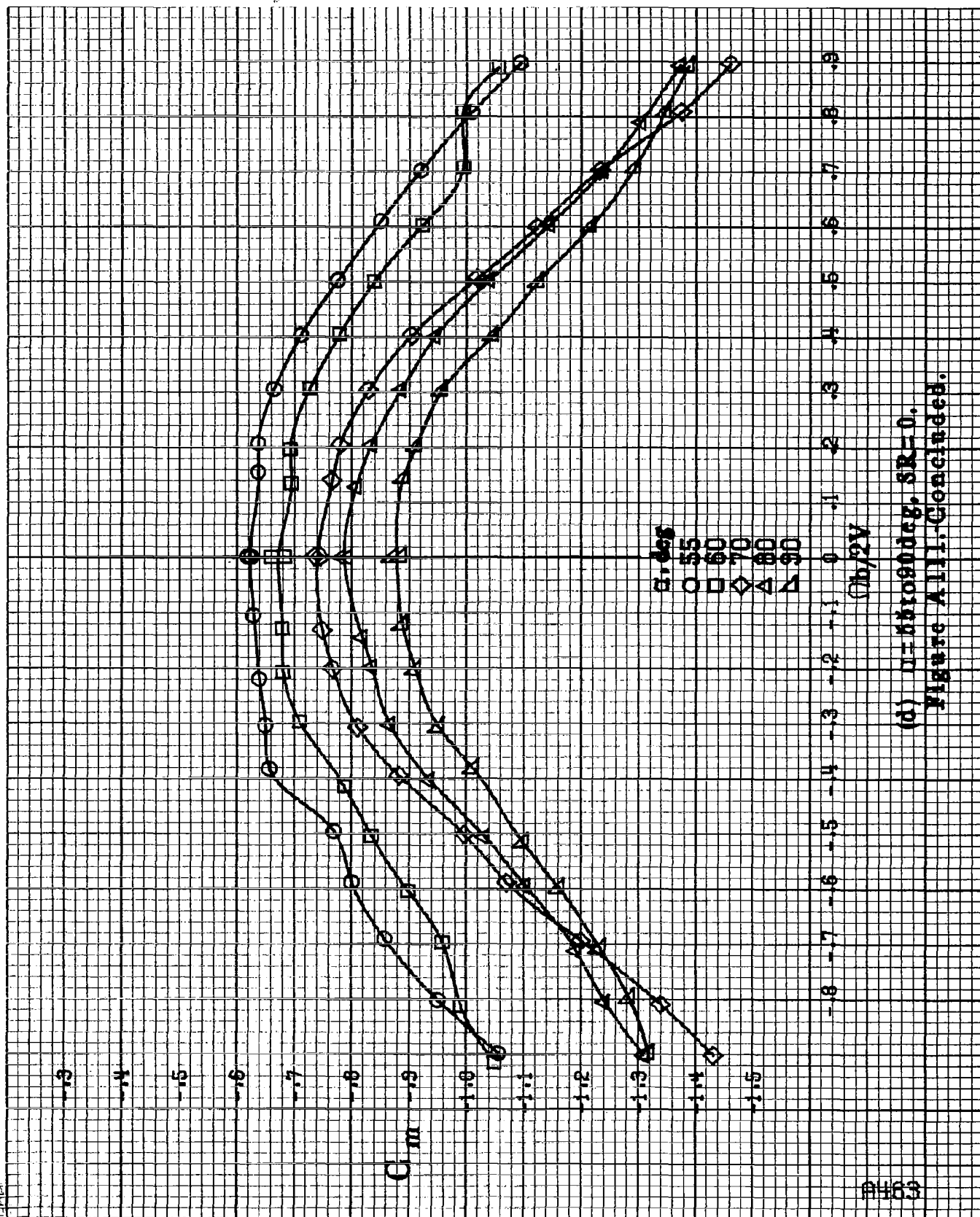


(b)  $u=18088\text{deg}$ ,  $SR=182.9\text{cm}$  (72in).  
Figure A111-Continued.

8462



(c)  $\alpha = 30$  to  $50$  deg,  $\delta R = 0$ .  
Figure A11.1. Continued.



(d)  $\alpha = 60$  to  $90$  deg,  $SR = 0$ .  
Figure A111-Concluded.

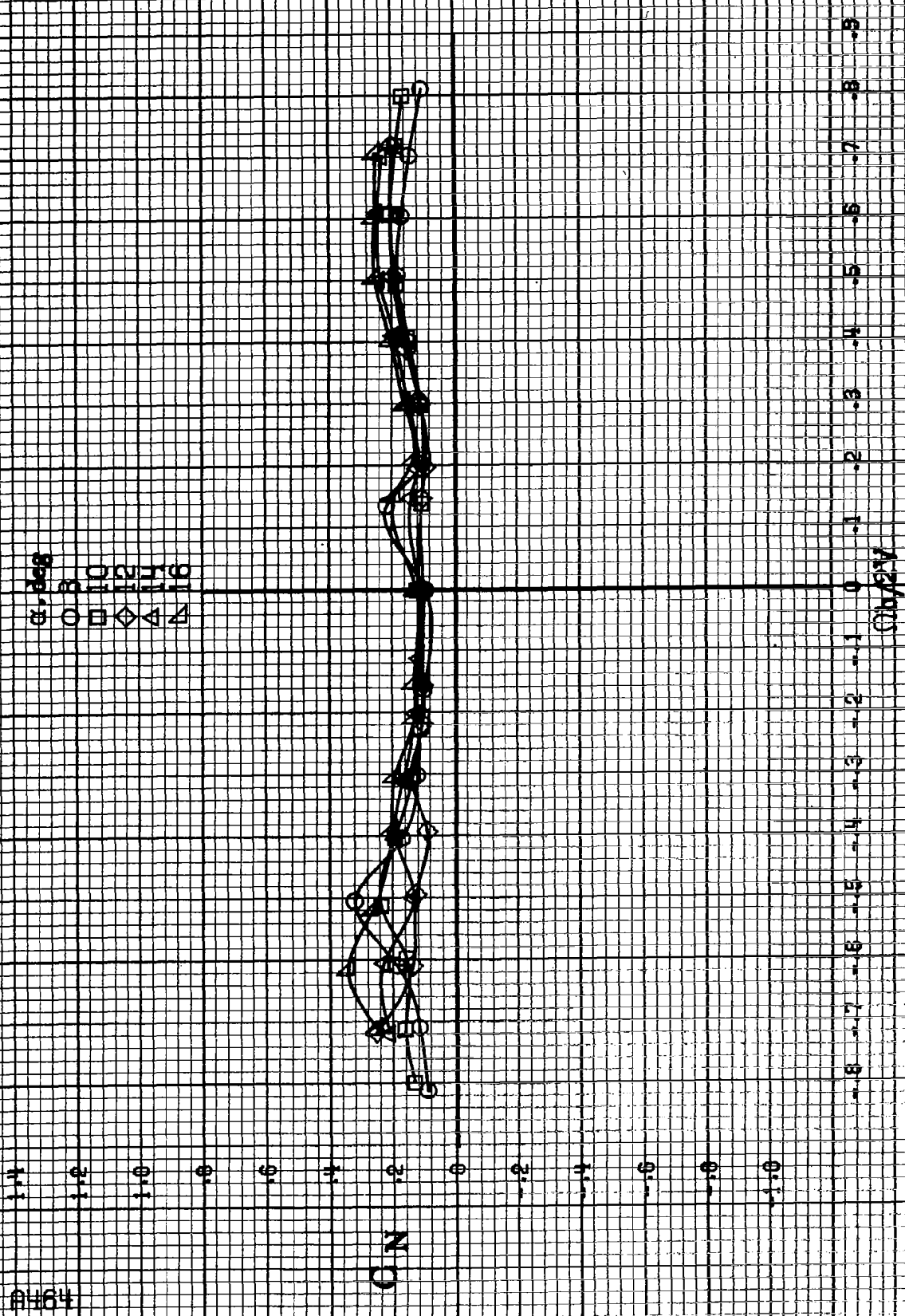
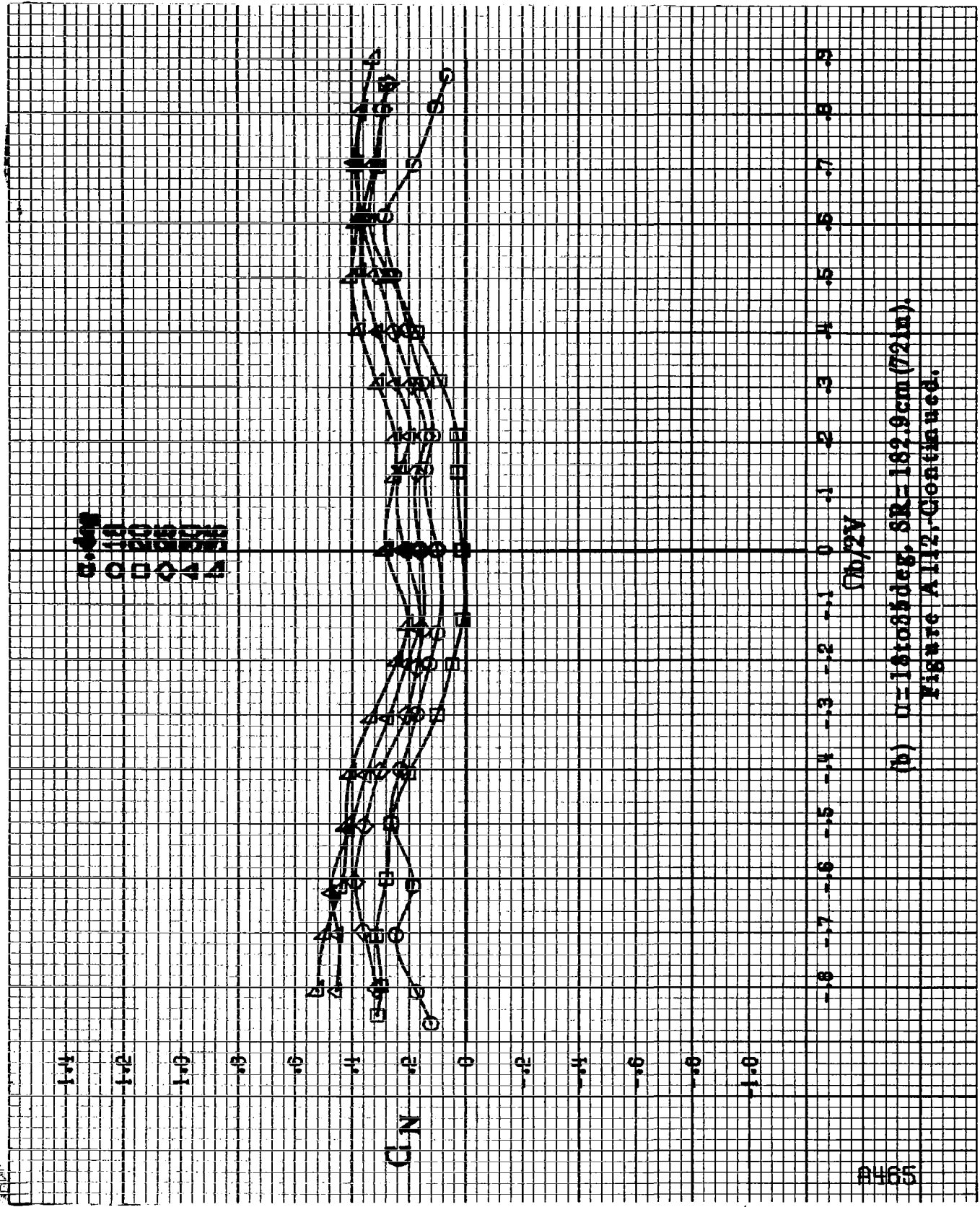
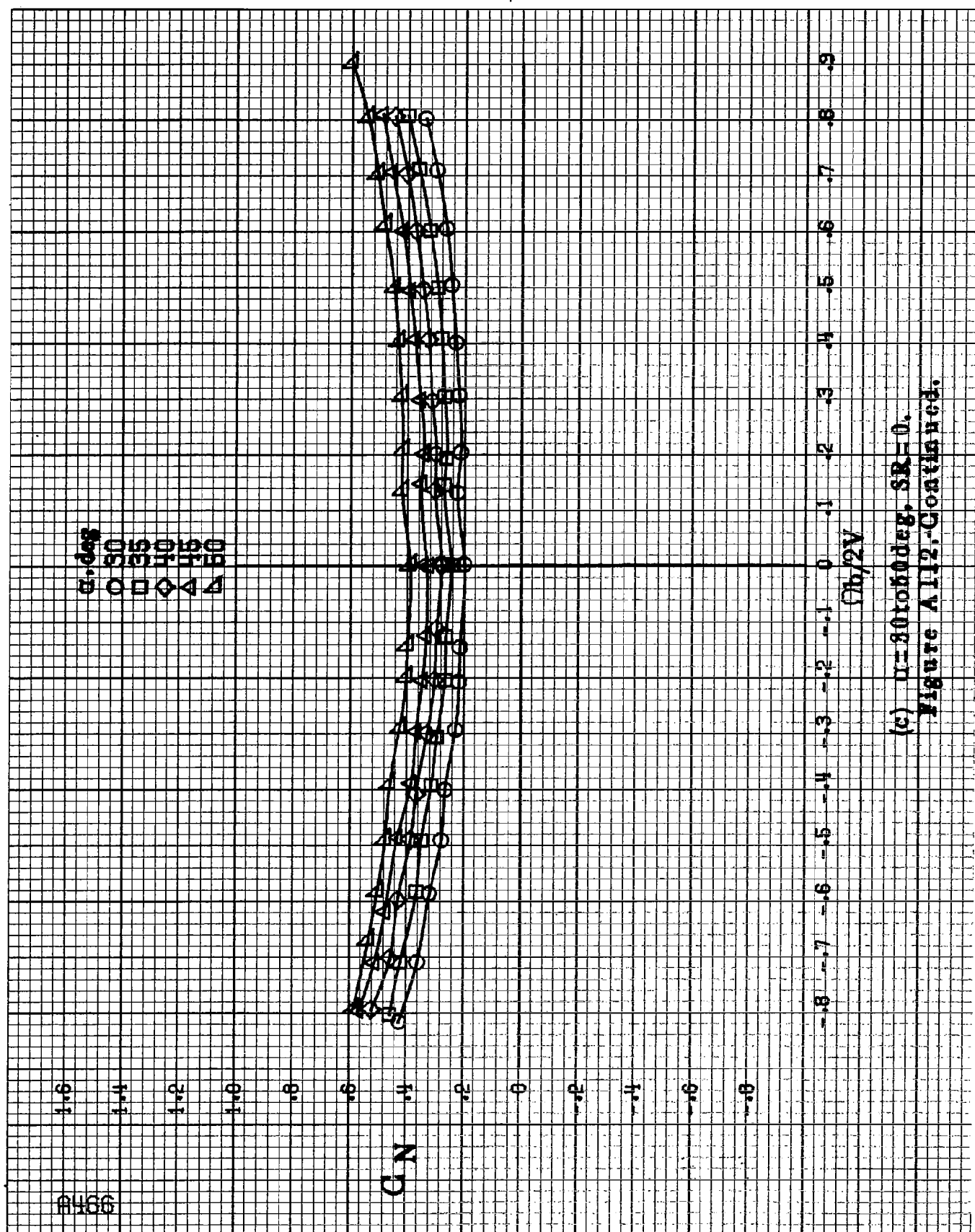
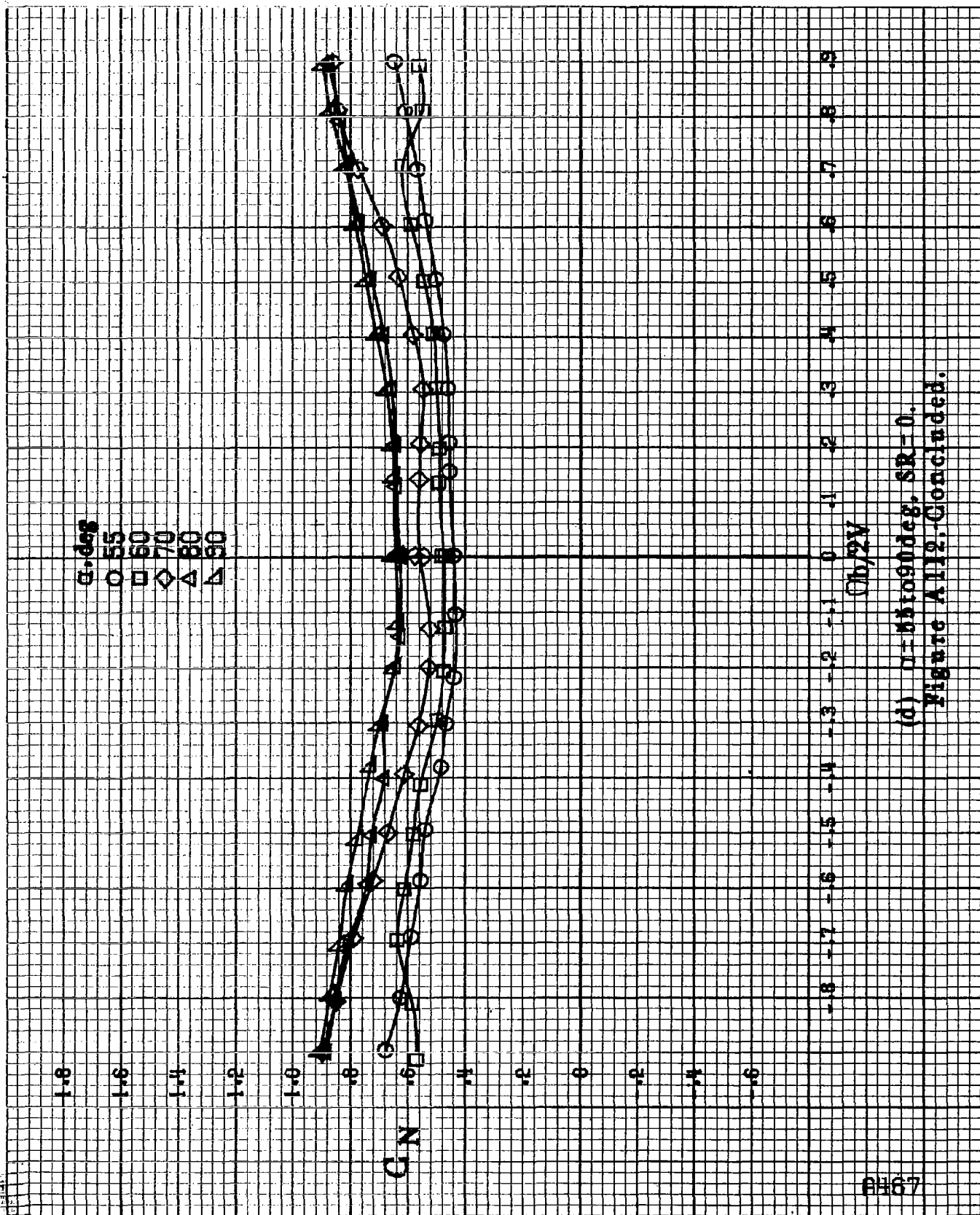


Figure 1112.-Effect of rotation rate and angle of attack on normal force coefficient for wing off configuration.  $\delta_1 = 0^\circ$ ,  $\delta_2 = 0^\circ$ ,  $\delta_3 = 0^\circ$ .



(b)  $\alpha = 1.6$  to  $8.4$  deg,  $SR = 162.9$  cm (72 in).  
Figure A112-Continued.





(d)  $\alpha = 85^\circ$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A112. Concluded.

8-58

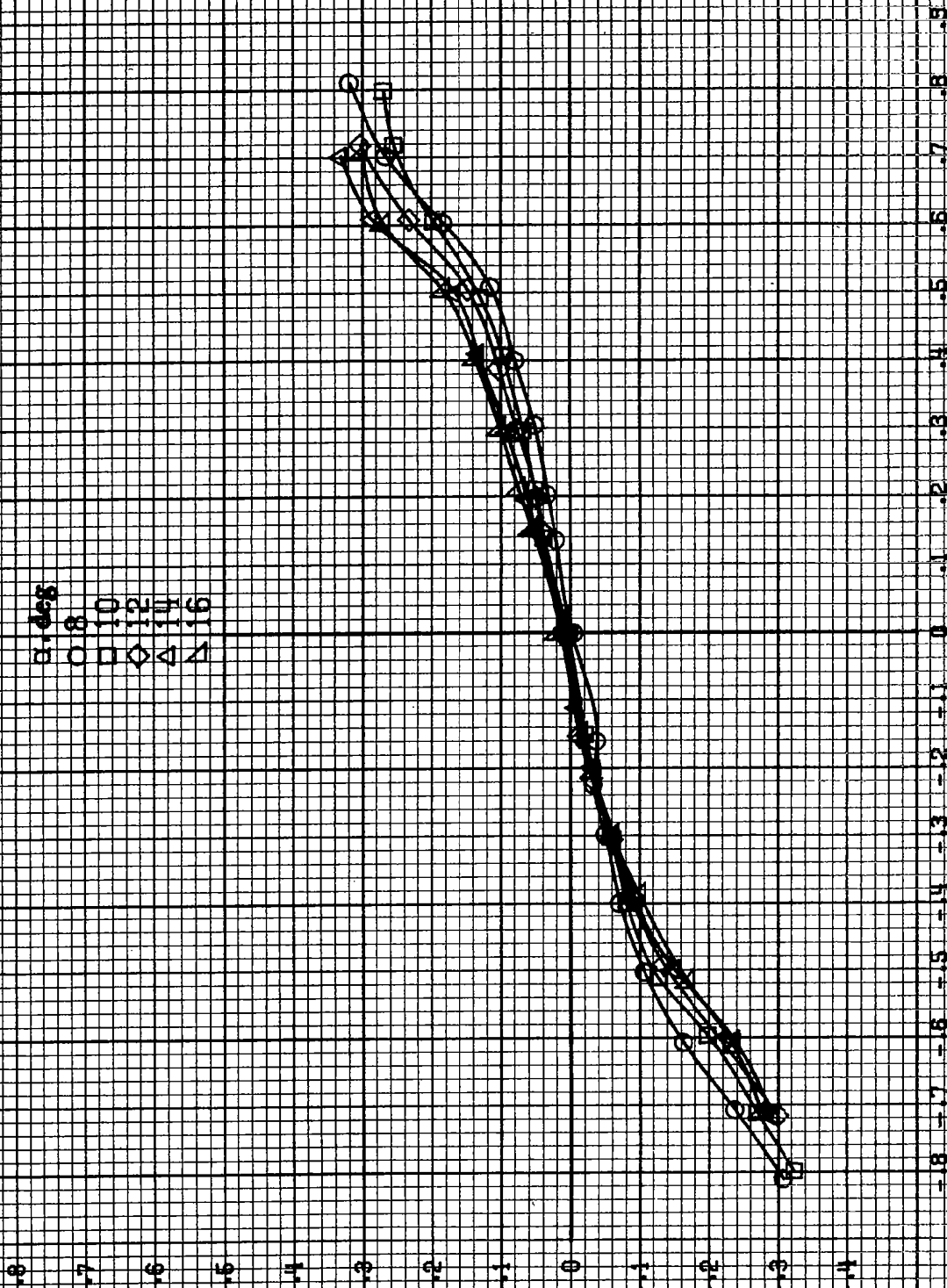
$\alpha$ , deg  
 ○ 8  
 □ 10  
 ◇ 12  
 △ 14  
 ▽ 16

$C_Y$

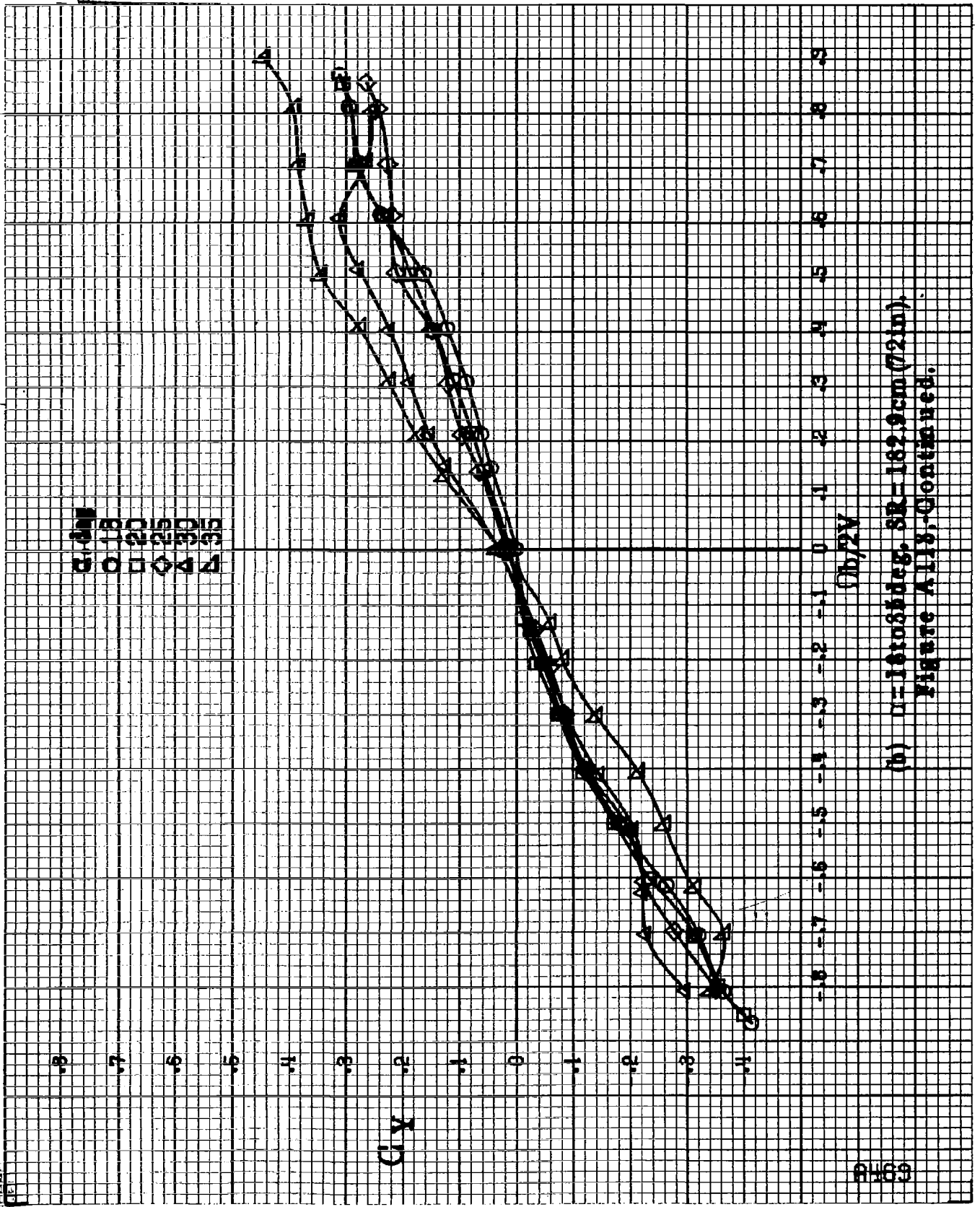
$b/2V$

(a)  $\alpha = 84.16^\circ$ ,  $SR = 182.9$  cm (72 in).

Figure A113.-Effect of rotation rate and angle of attack on side-force coefficient for wing off configuration.  $\delta_e \pm 0^\circ$ ,  $\delta_a \pm 0^\circ$ ,  $\delta_r \pm 0^\circ$ ,  $\beta \pm 0^\circ$ .







(b)  $\alpha = 18.085 \text{ deg}$ ,  $SR = 162.9 \text{ cm (72 in)}$ ,  
Figure A118, Continued.

A470

.8

.7

.6

.5

.4

.3

$C_Y$

.2

.1

0

.1

.2

.3

.4

$\alpha, \text{deg}$

30

35

40

45

50

.3

.8

.7

.6

.5

.4

.3

.2

.1

0

-.1

-.2

-.3

-.4

-.5

-.6

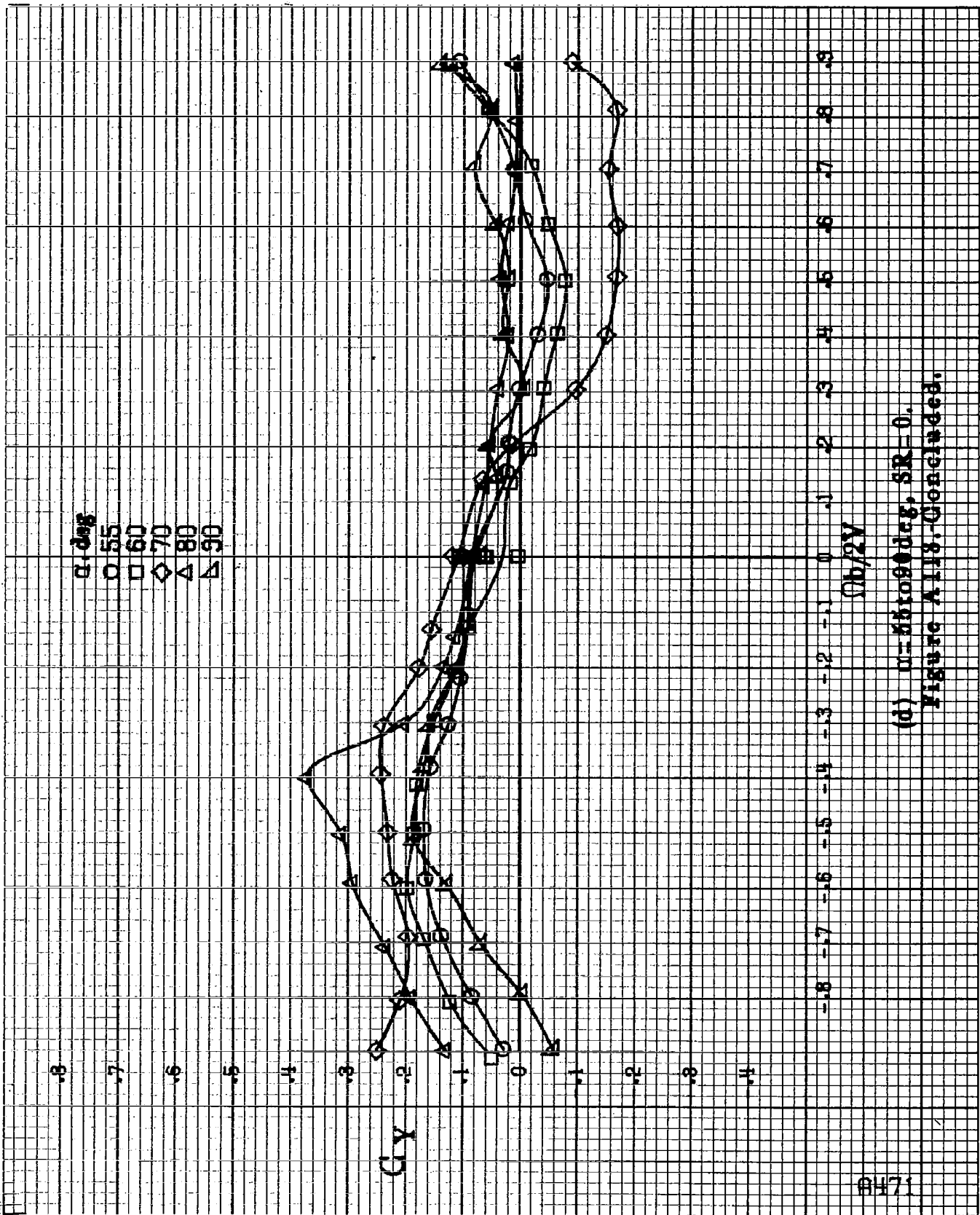
-.7

-.8

$\Omega b/2V$

(c)  $\alpha = 30$  to  $50$  deg,  $SR = 0$ .

Figure A118-Continued.



(d)  $u=881090$  deg,  $SR=0$ .  
Figure A118. Concluded.

$\alpha, \text{deg}$   
 8  
 10  
 12  
 14  
 16

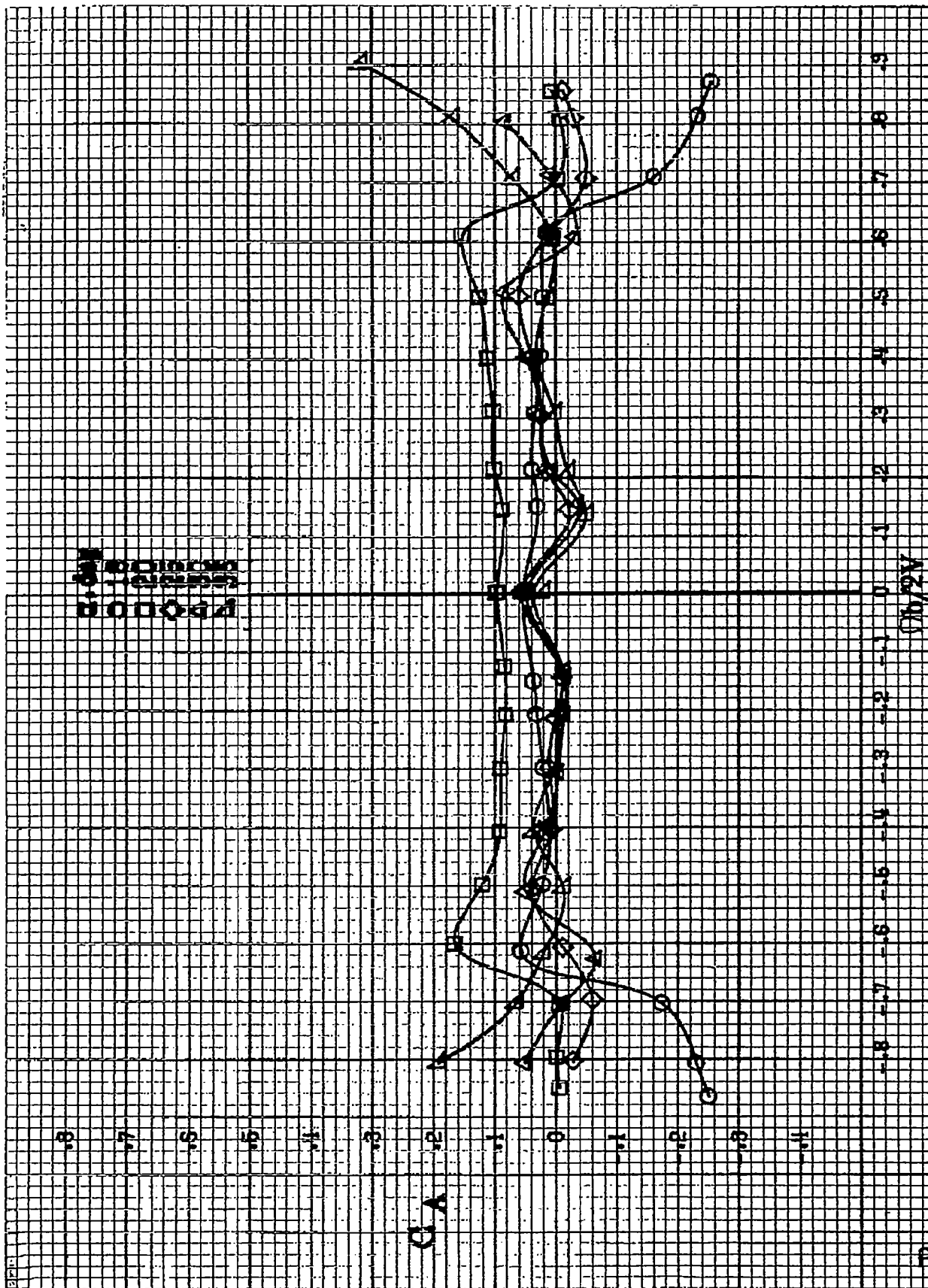
$C_A$



$\Omega b/2V$

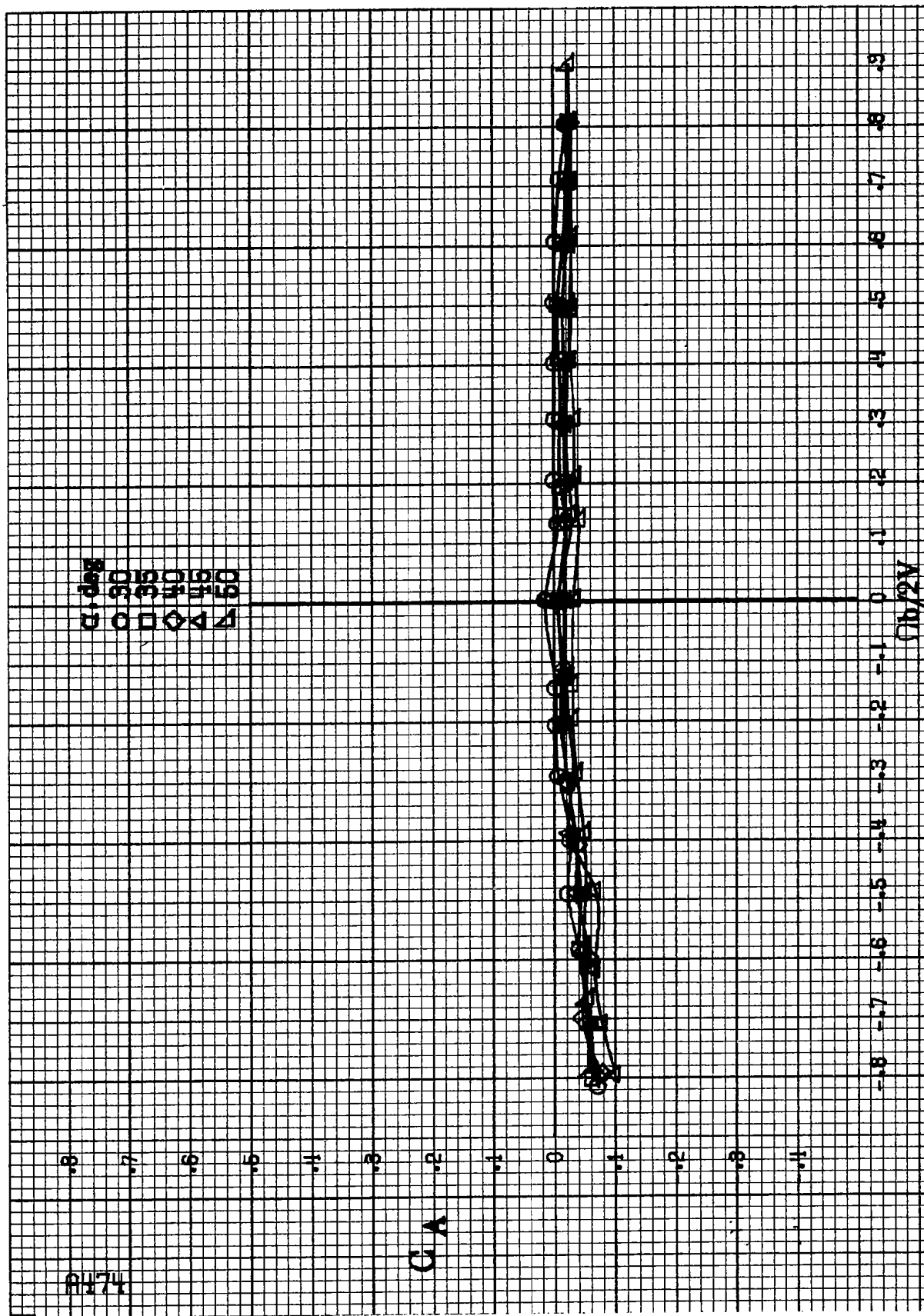
(a)  $\alpha=8$  to  $16^\circ$ ,  $SR=132.9 \text{ cm (72 in.)}$ .

Figure A114.-Effect of rotation rate and angle of attack on lift coefficient for wing off configuration.  $\delta_a=0^\circ$ ,  $\delta_r=0^\circ$ ,  $\beta=0^\circ$ .

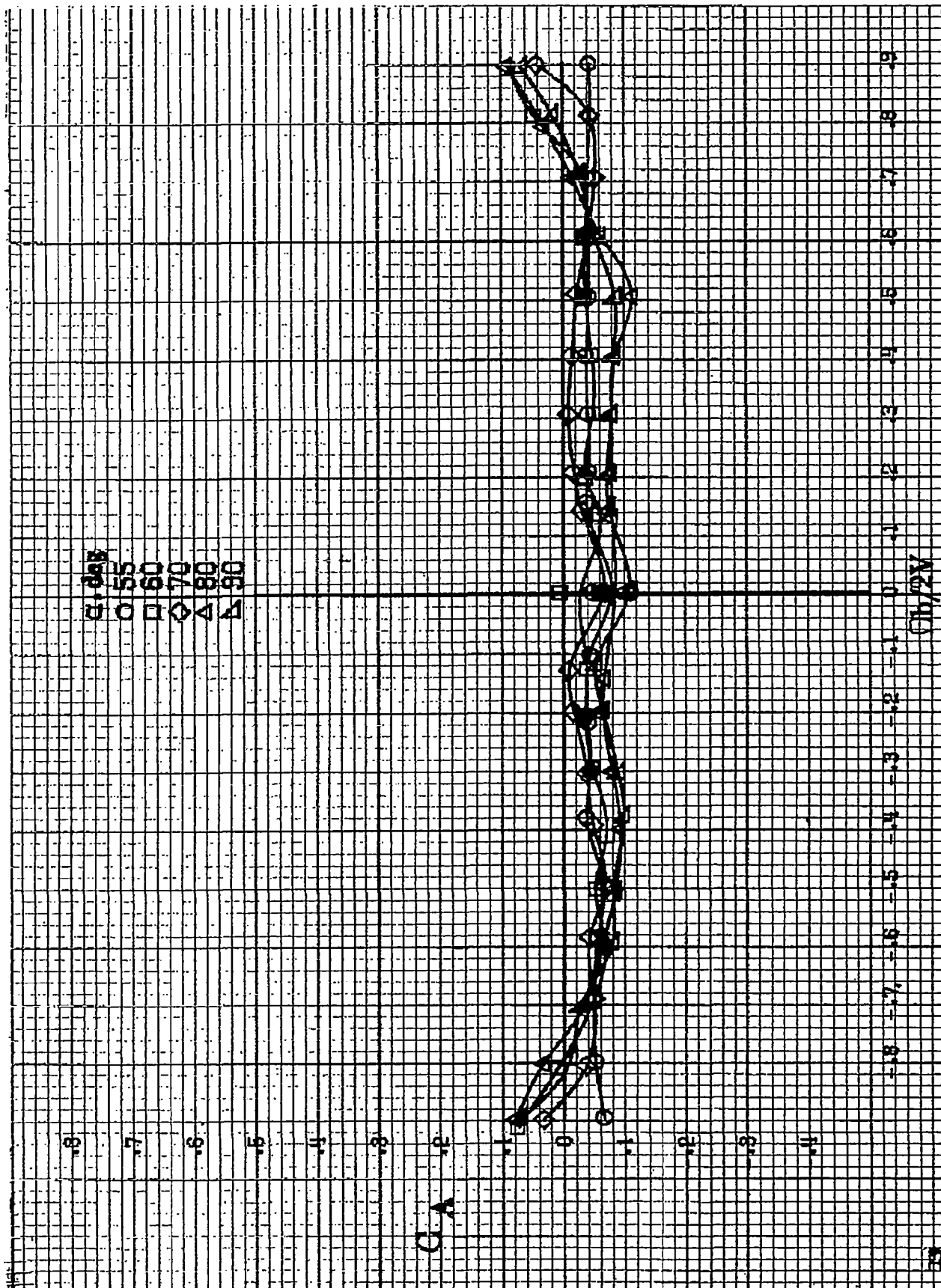


(b) U-14085deg, SR-162.8cm (72in).

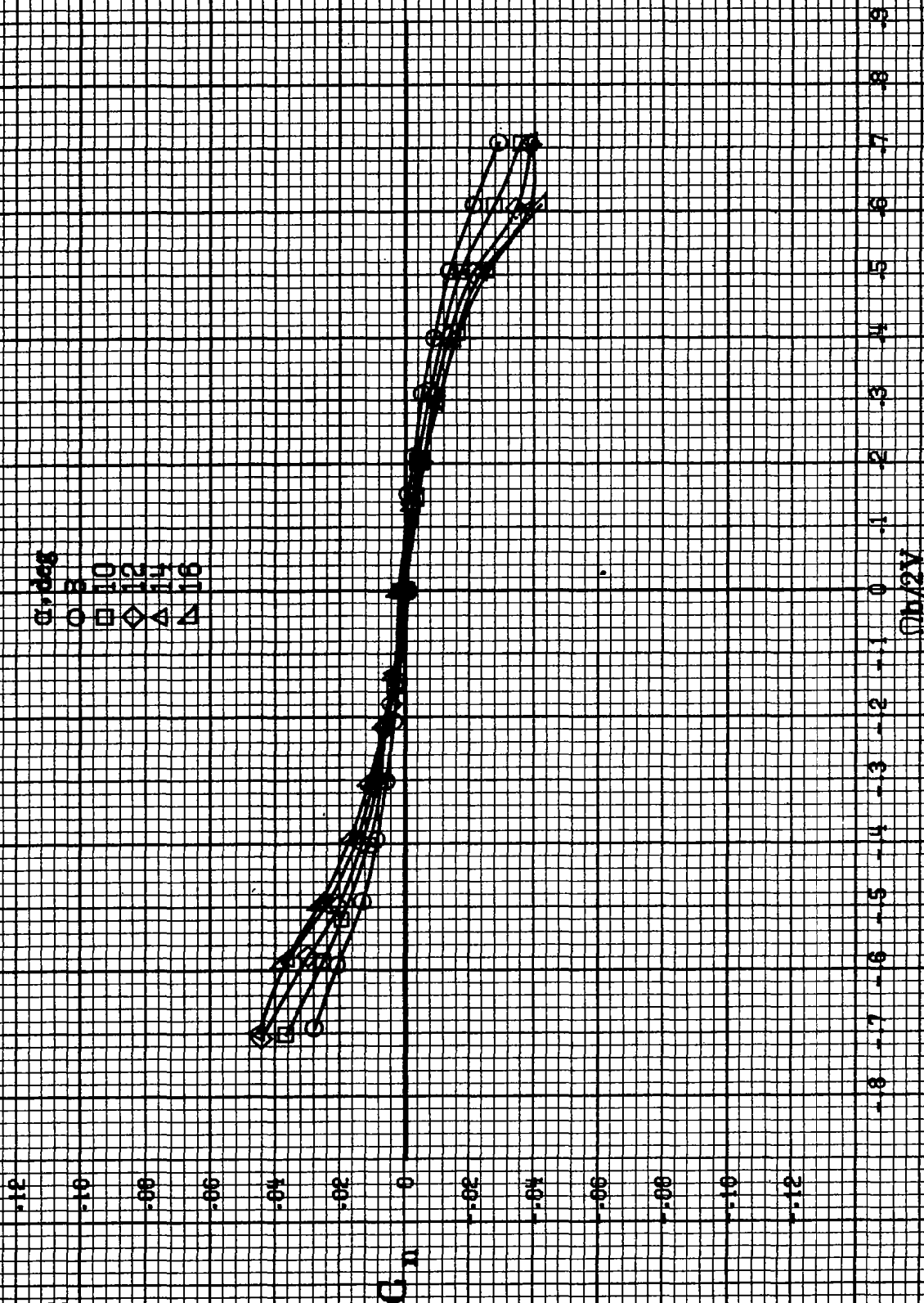
Figure A11.1-Continued.



(c)  $\alpha = 80$  to  $60$  deg,  $SR = 0$ .  
Figure A11.1-Continued.



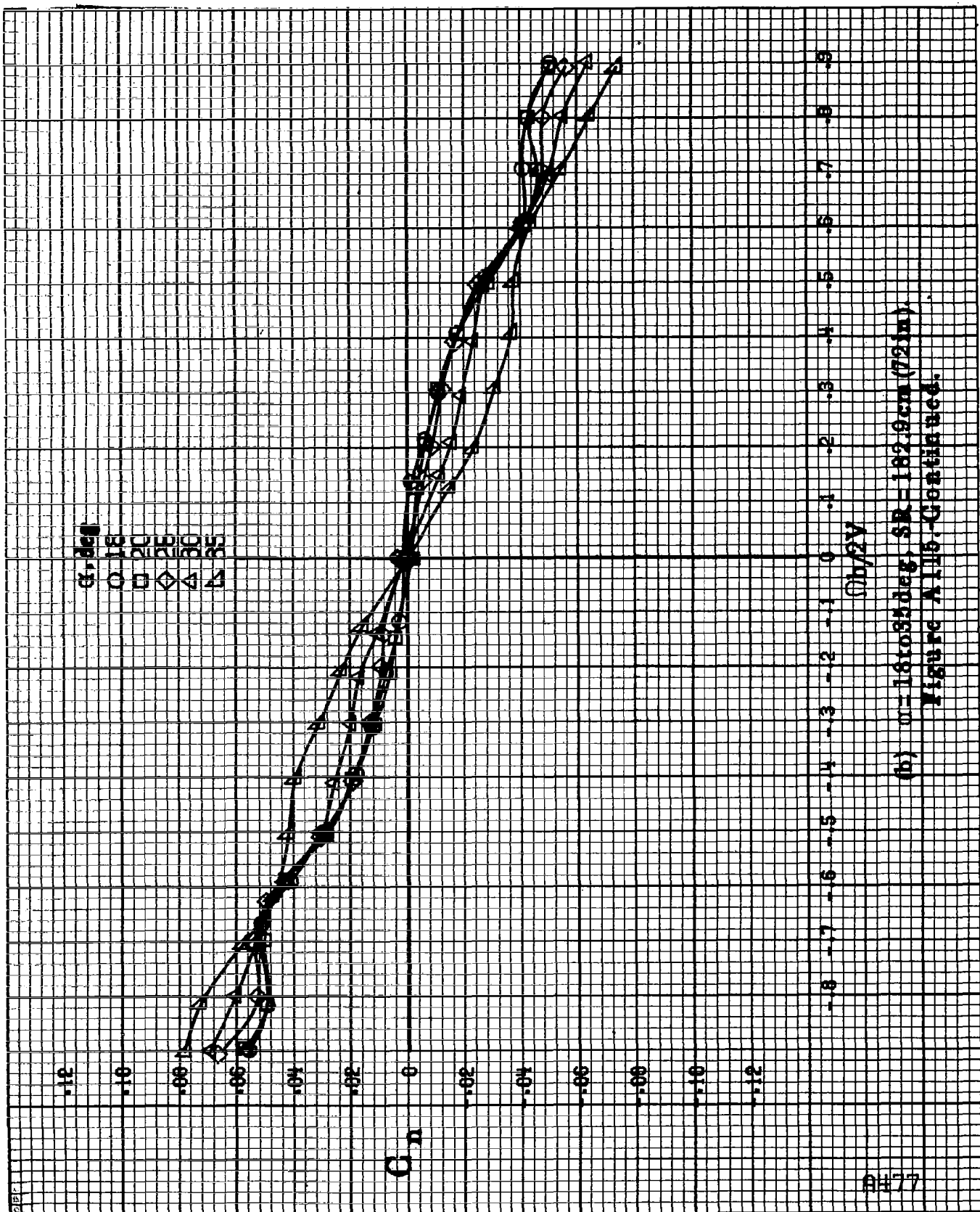
(d)  $\gamma = 60^\circ$  to  $90^\circ$  deg,  $SR = 0$ .  
Figure A11.1. Concluded.



(a)  $\alpha = 8$  to  $16^\circ$ ,  $SR = 182.9$  cm (72 in).

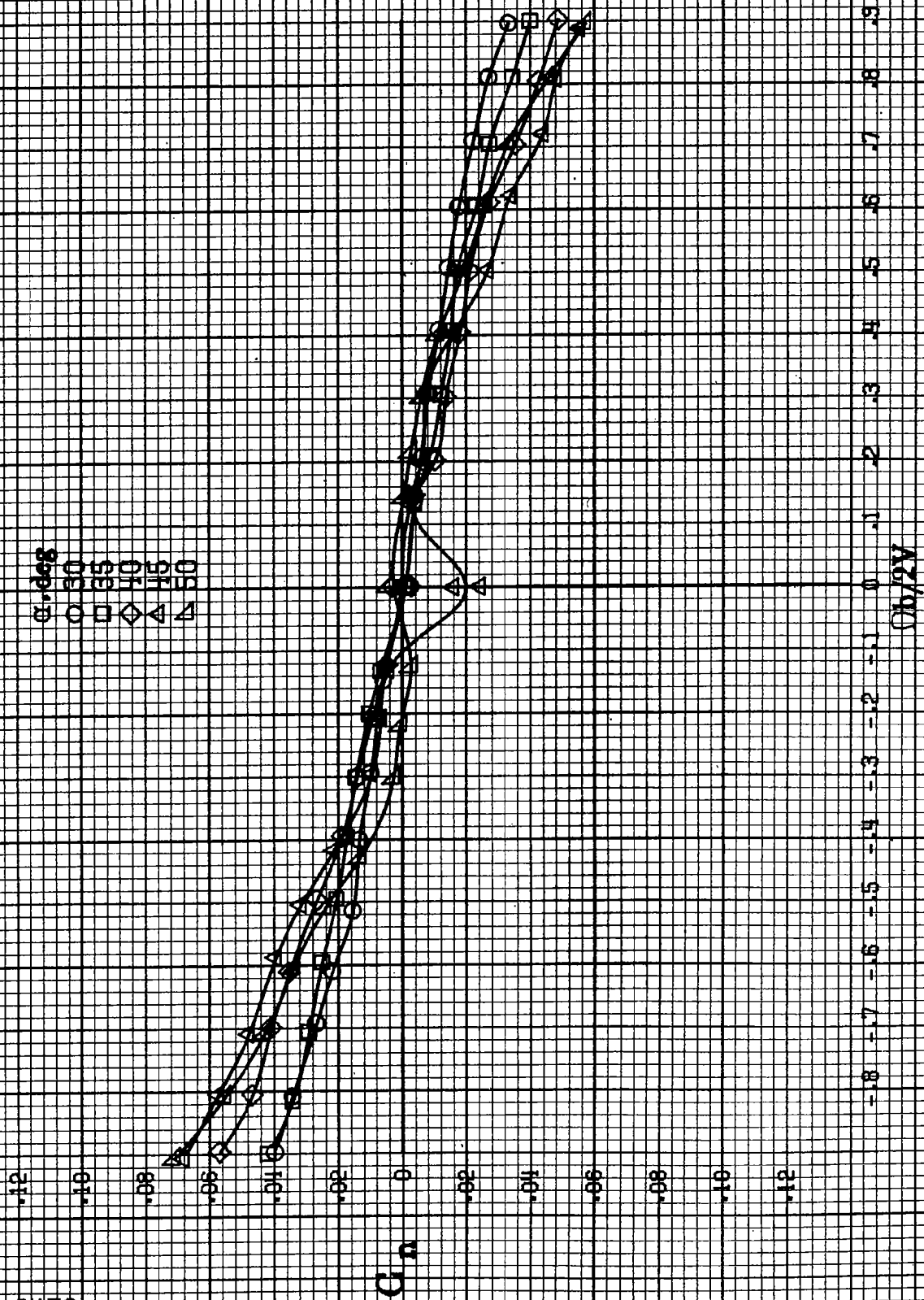
Figure A115.-Effect of notation rate and angle of attack on yawing-moment coefficient for wing and horizontal tail off configuration.  $\delta_a = 0^\circ$ ,  $\delta_r = 0^\circ$ .



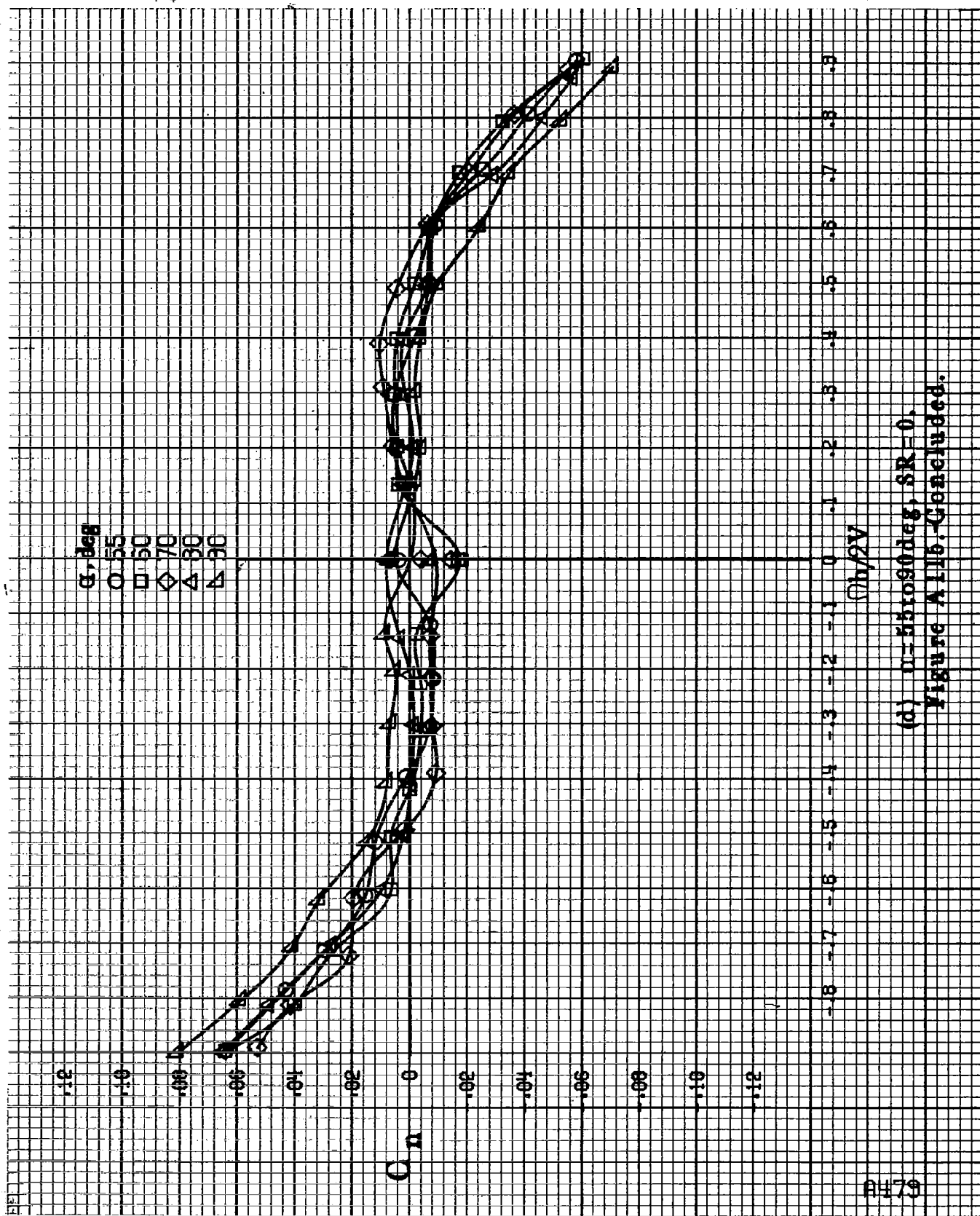


(b)  $\alpha=18$  to  $35$  deg,  $SR=182.9$  cm (72 in).  
Figure A115-Continued.

0478



(c)  $\alpha=30$  to  $50^\circ$ ,  $SR=0$ .  
Figure A11b-Continued.



(d)  $\alpha = 55$  to  $90$  deg,  $SR = 0$ .  
Figure A116. Concluded.

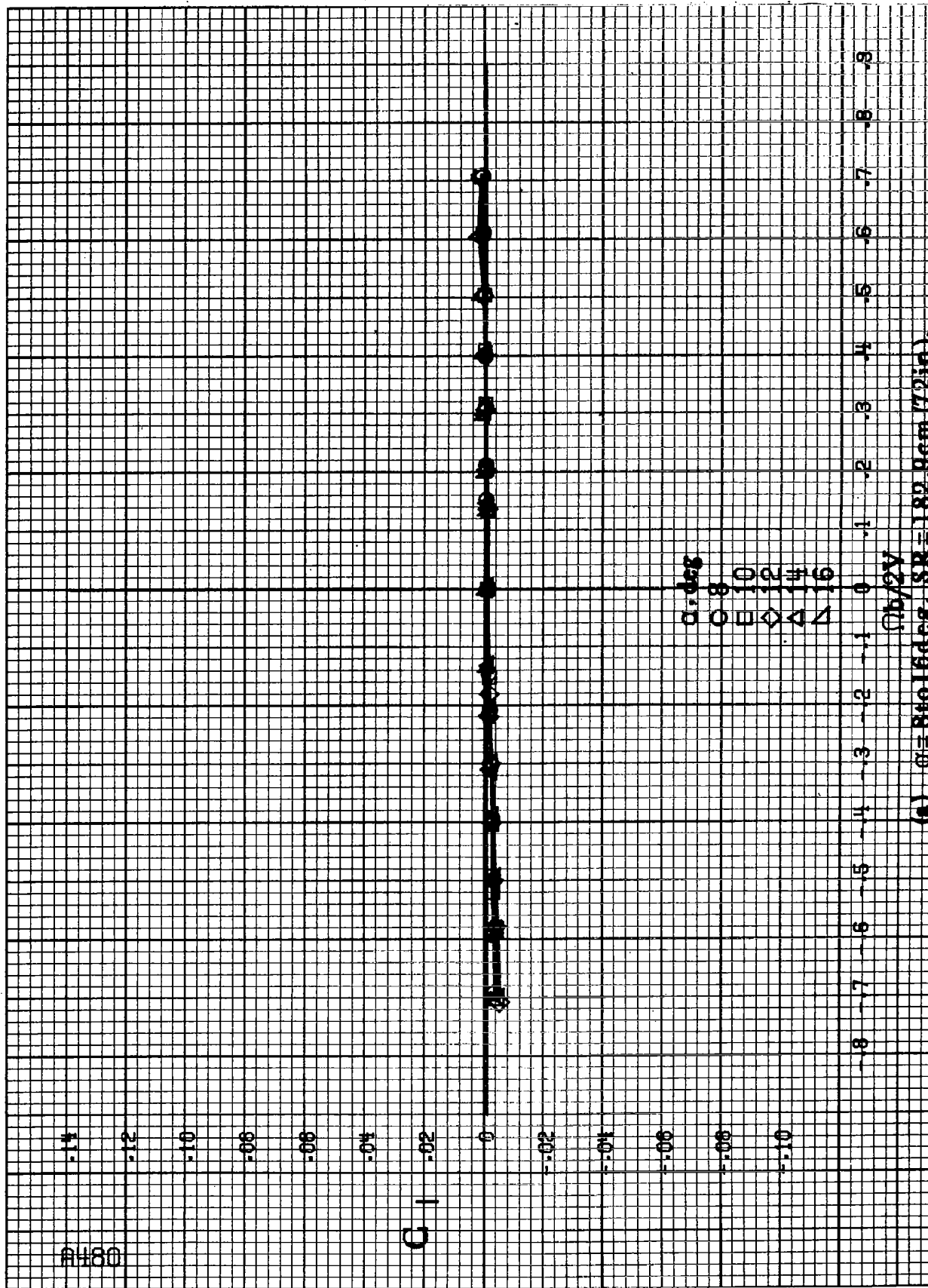
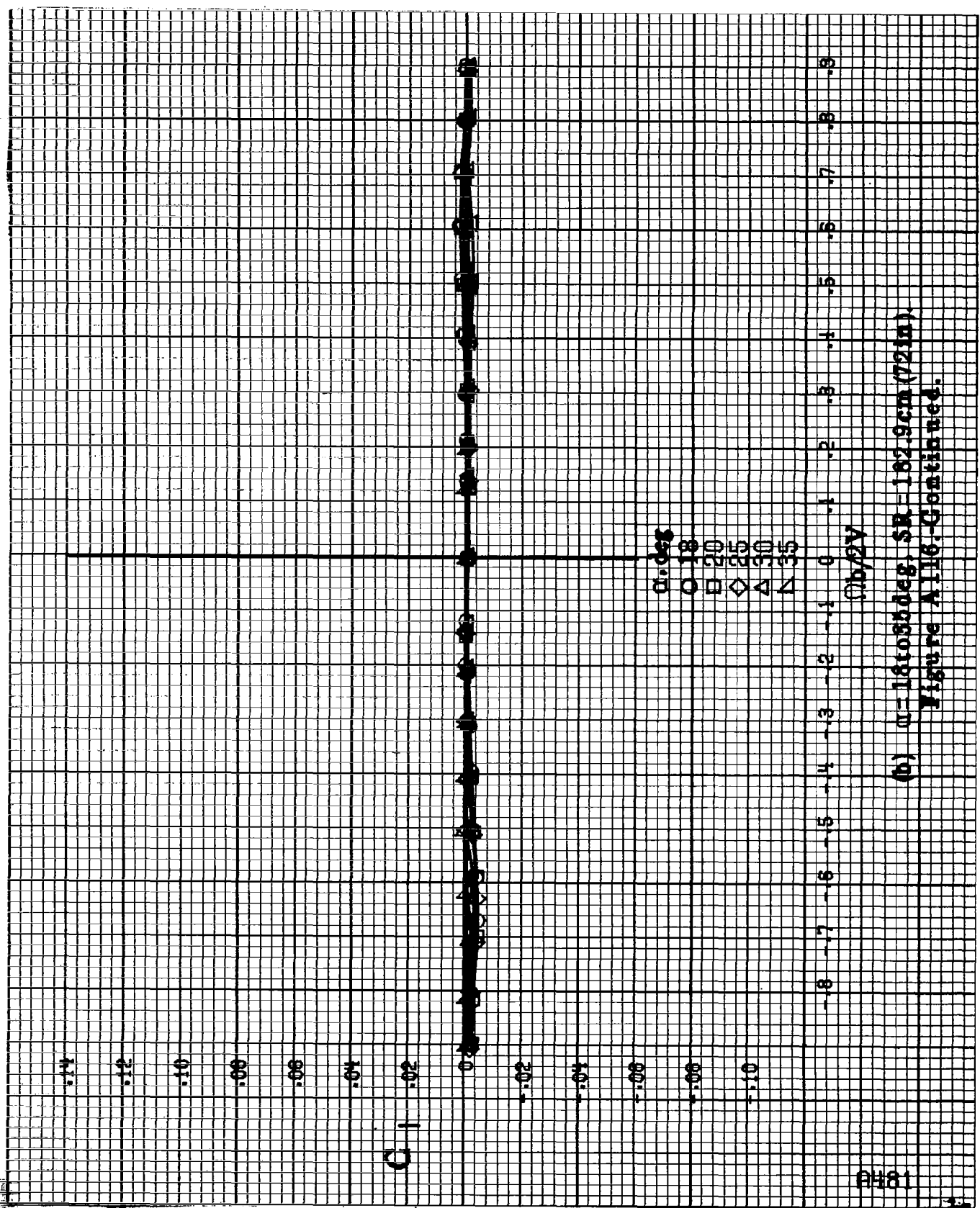


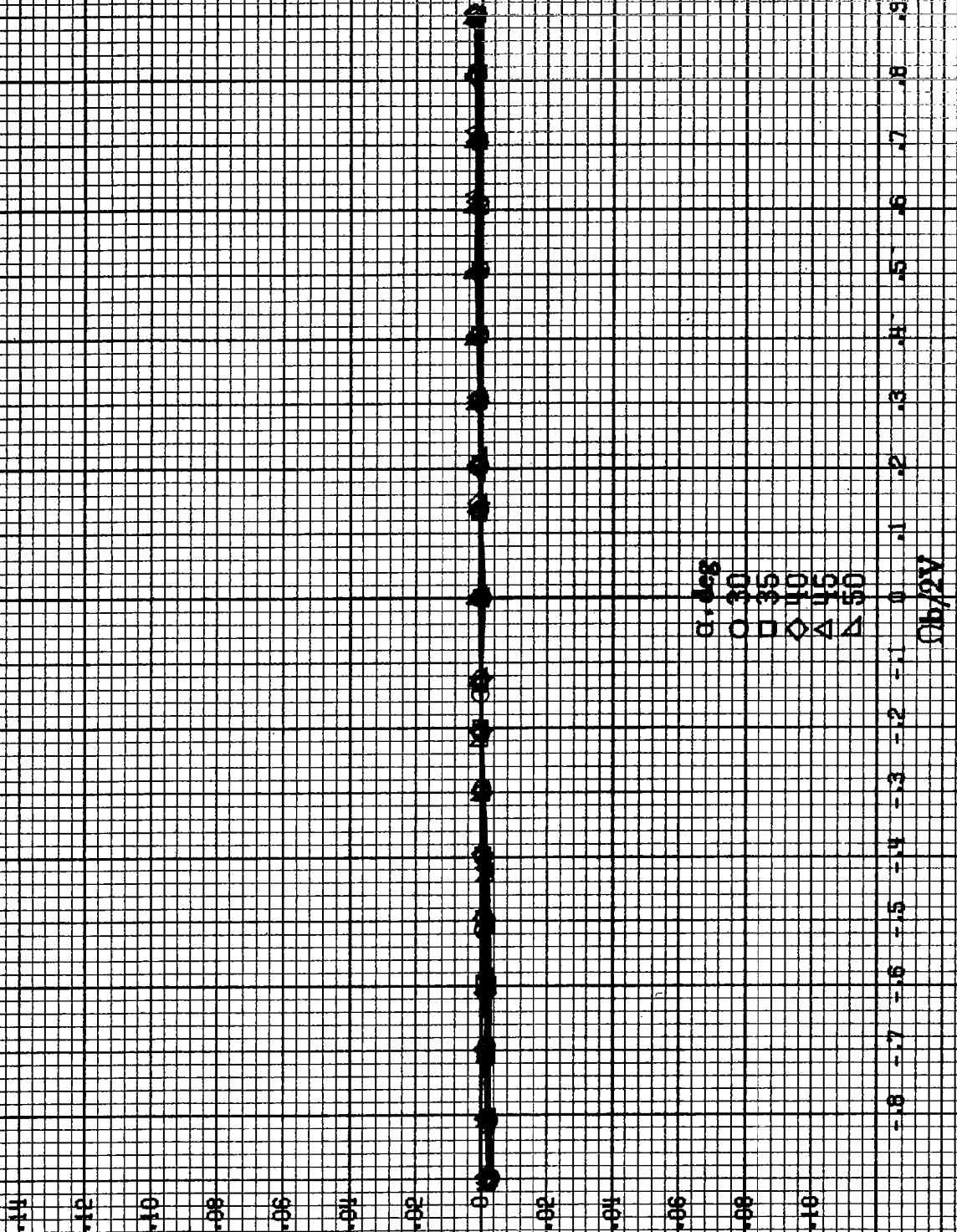
Figure A116-Effect of rotation rate and angle of attack on rolling-moment coefficient for wing and horizontal tail off configuration.  $\delta_s = 0^\circ$ ,  $\delta_a = 0^\circ$ .  $\alpha = 8$  to  $16$  deg,  $SR = 182.9$  cm (72 in).



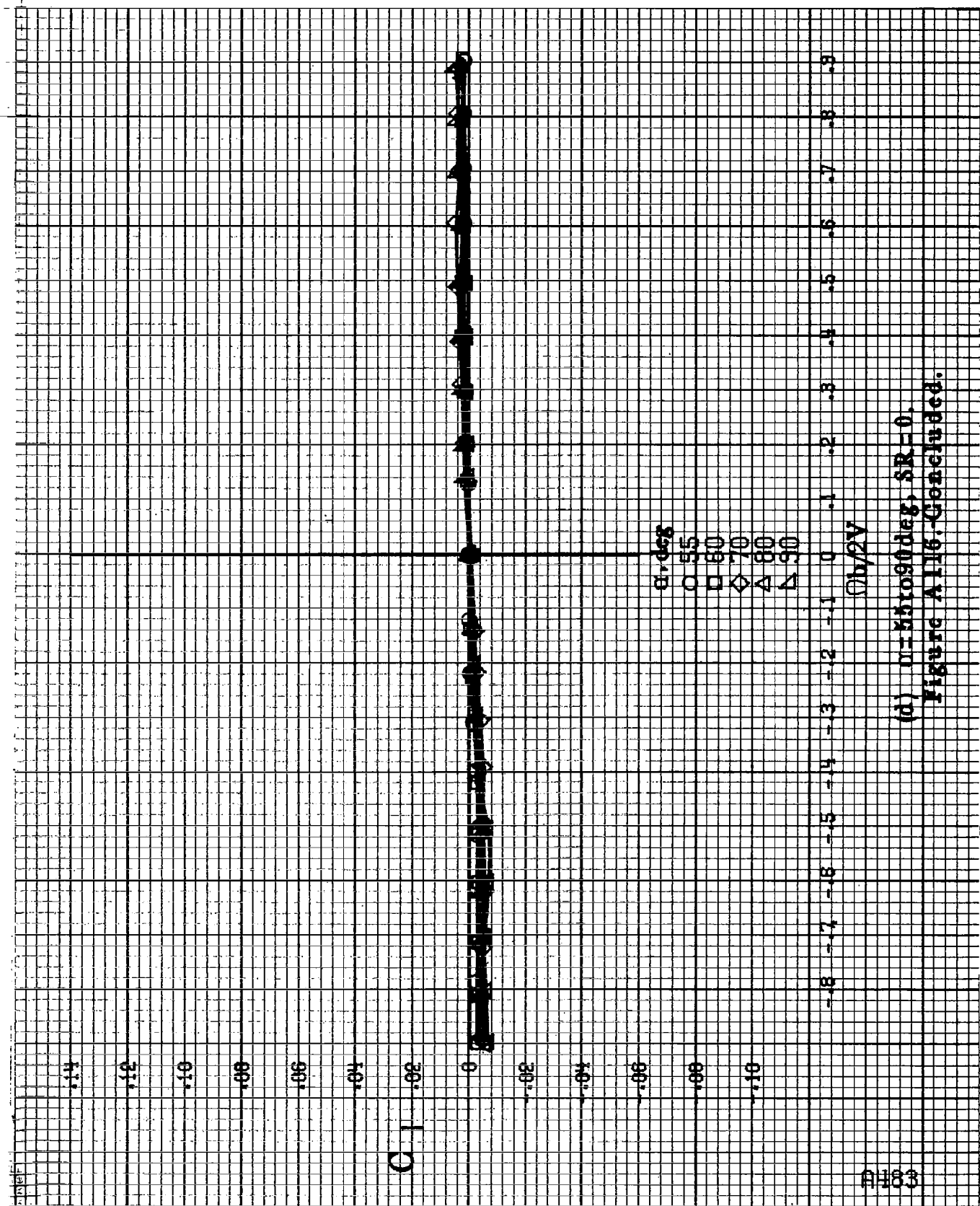
(b)  $\alpha = 18$  to  $35$  deg,  $SR = 182.9 \text{ cm (72 in)}$   
 Figure A116-Continued.

PH82

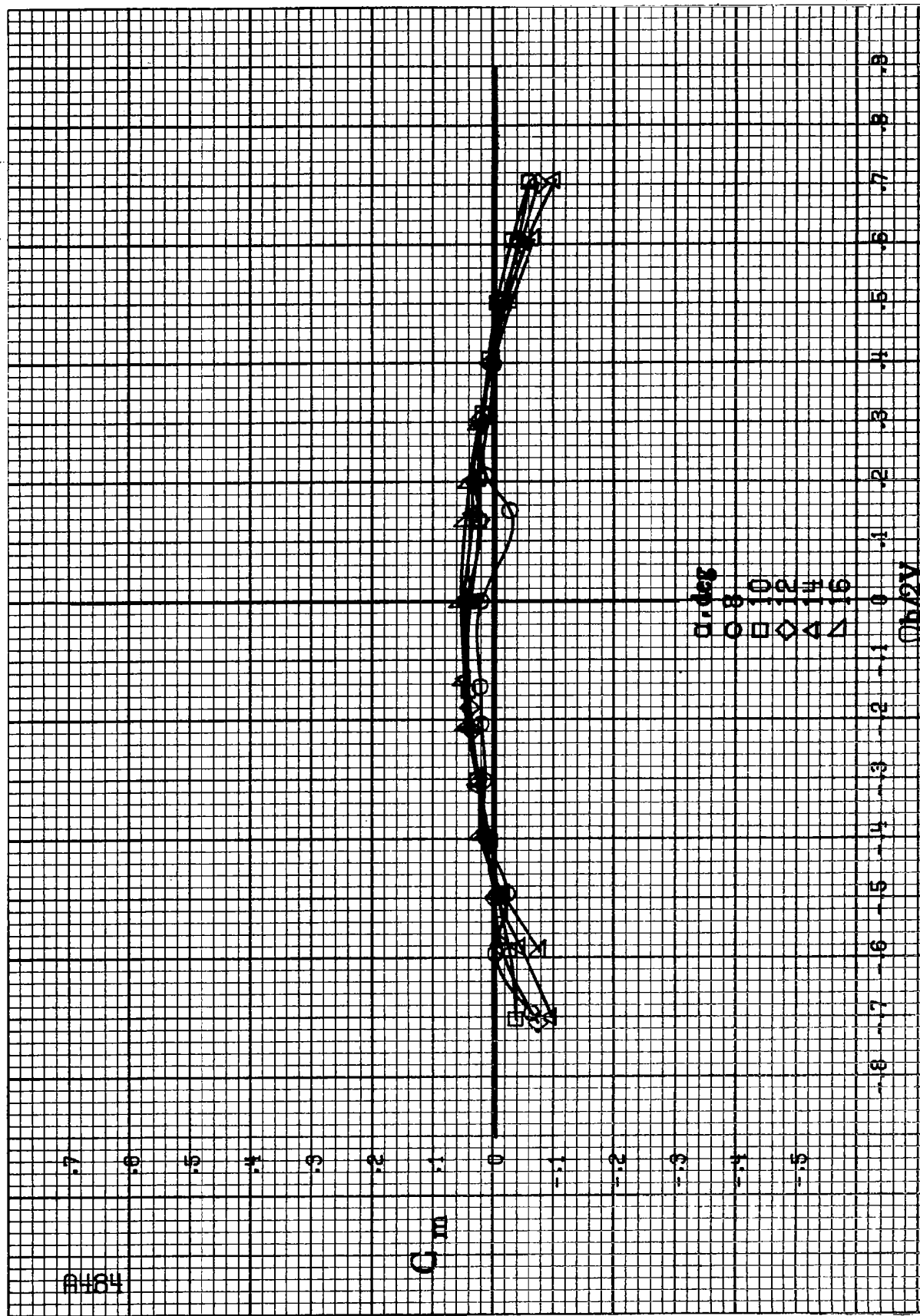
$G_1$



(c)  $\alpha = 80$  to  $80$  deg,  $SR = 0$ ,  
Figure A116-Continued.

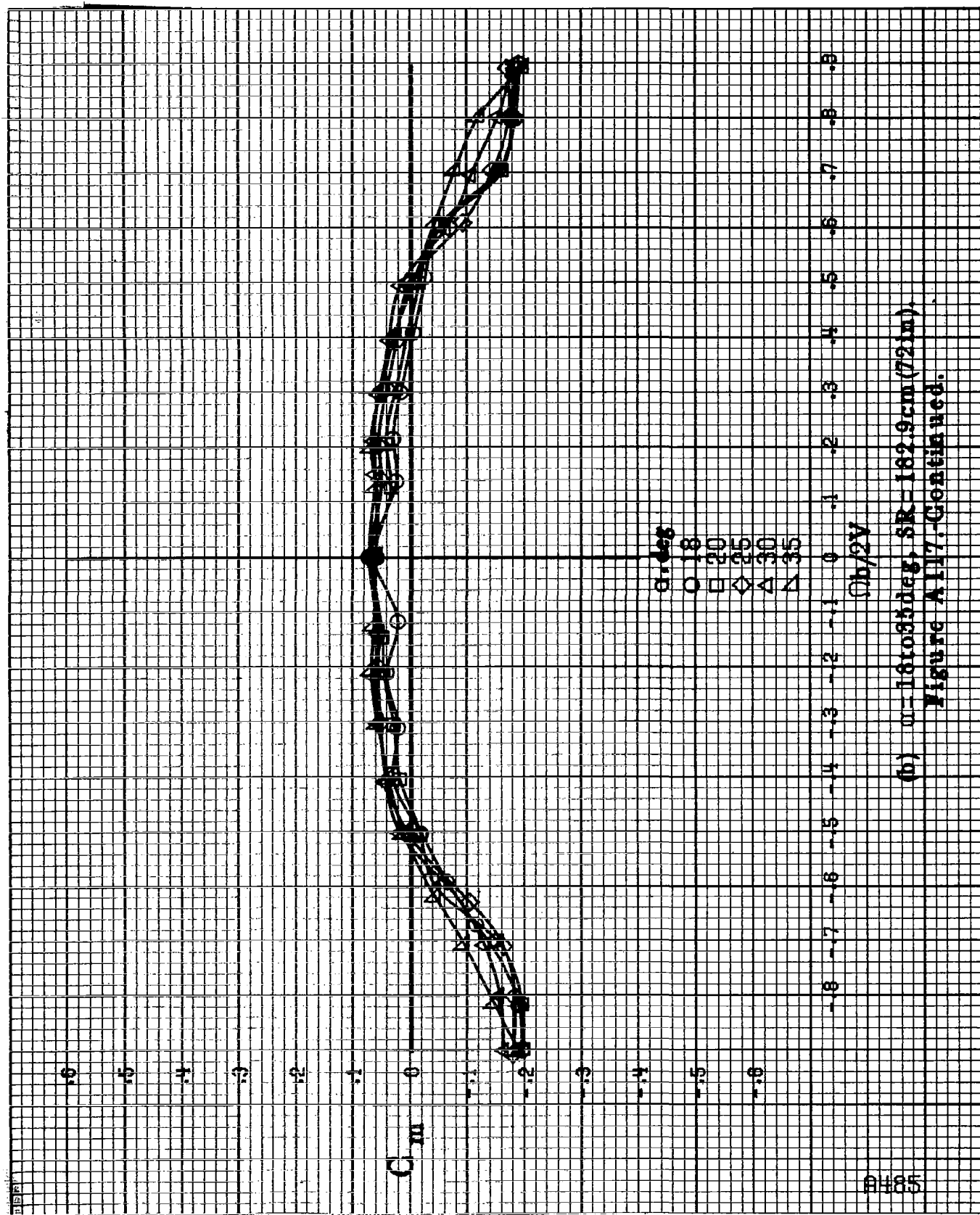


(d)  $\theta = 55$  to  $90^\circ$  deg,  $SR = 0$ .  
Figure A116. Concluded.

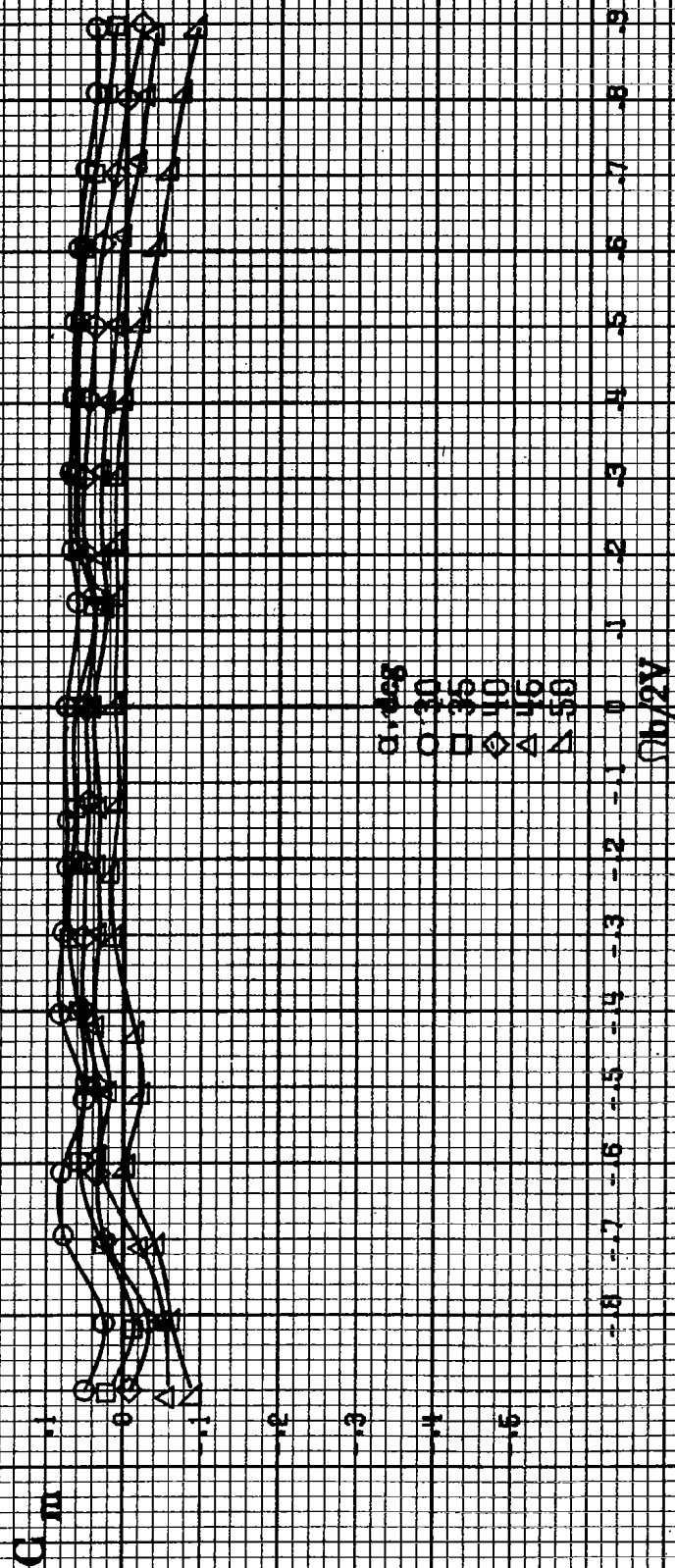


(a)  $\alpha = 8$  to  $16$  deg,  $SR = 132.9$  cm (72 in.).  
 Figure A117. Effect of rotation rate and angle of attack on pitching moment coefficient for wing and horizontal tail off configuration.  $\delta_a = 0^\circ$ ,  $\delta_h = 0^\circ$ ,  $\beta = 0^\circ$ .

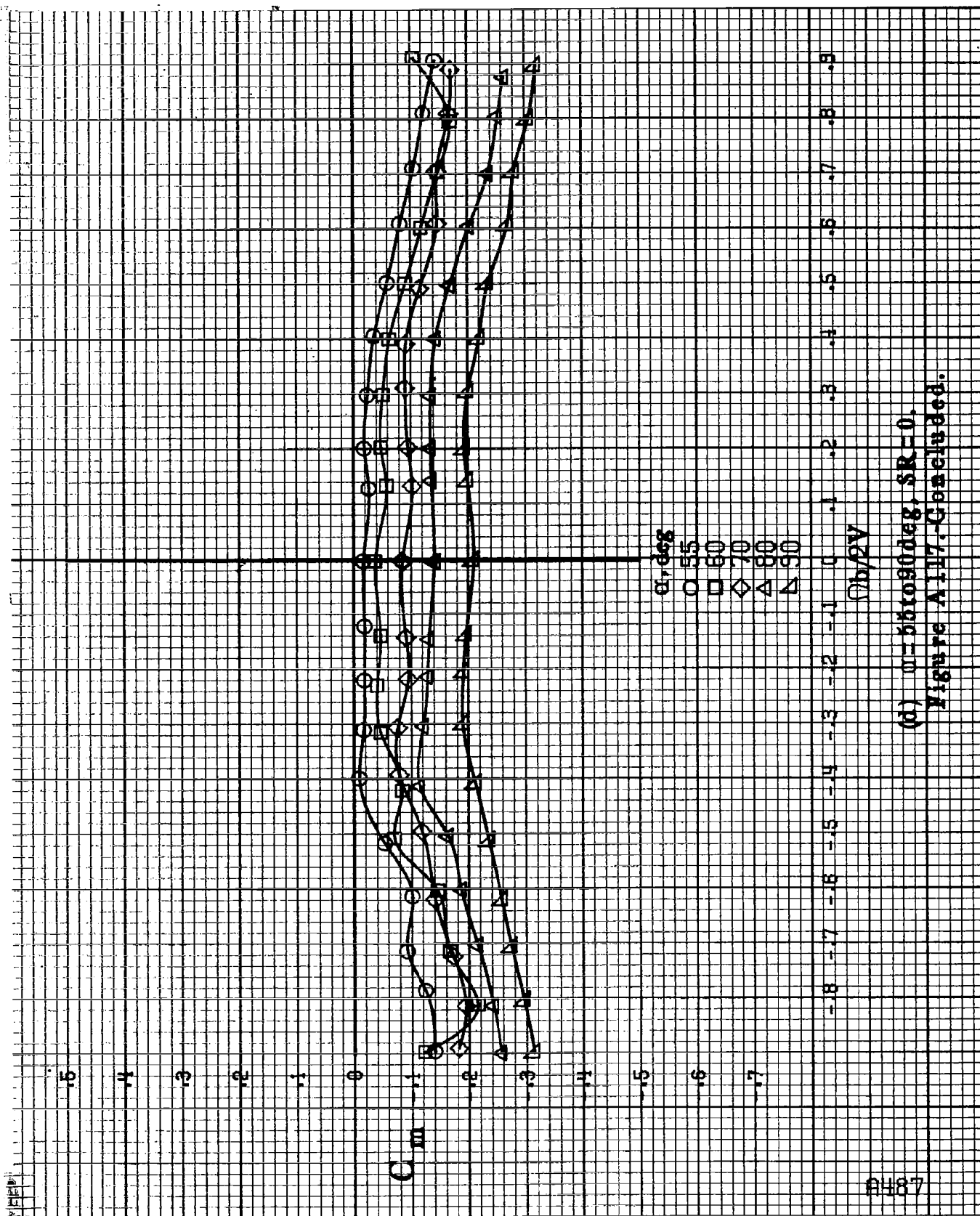




(b)  $\omega=18108\text{deg}$ ,  $SR=182.9\text{cm}(72\text{in})$ .  
Figure A117. Continued.



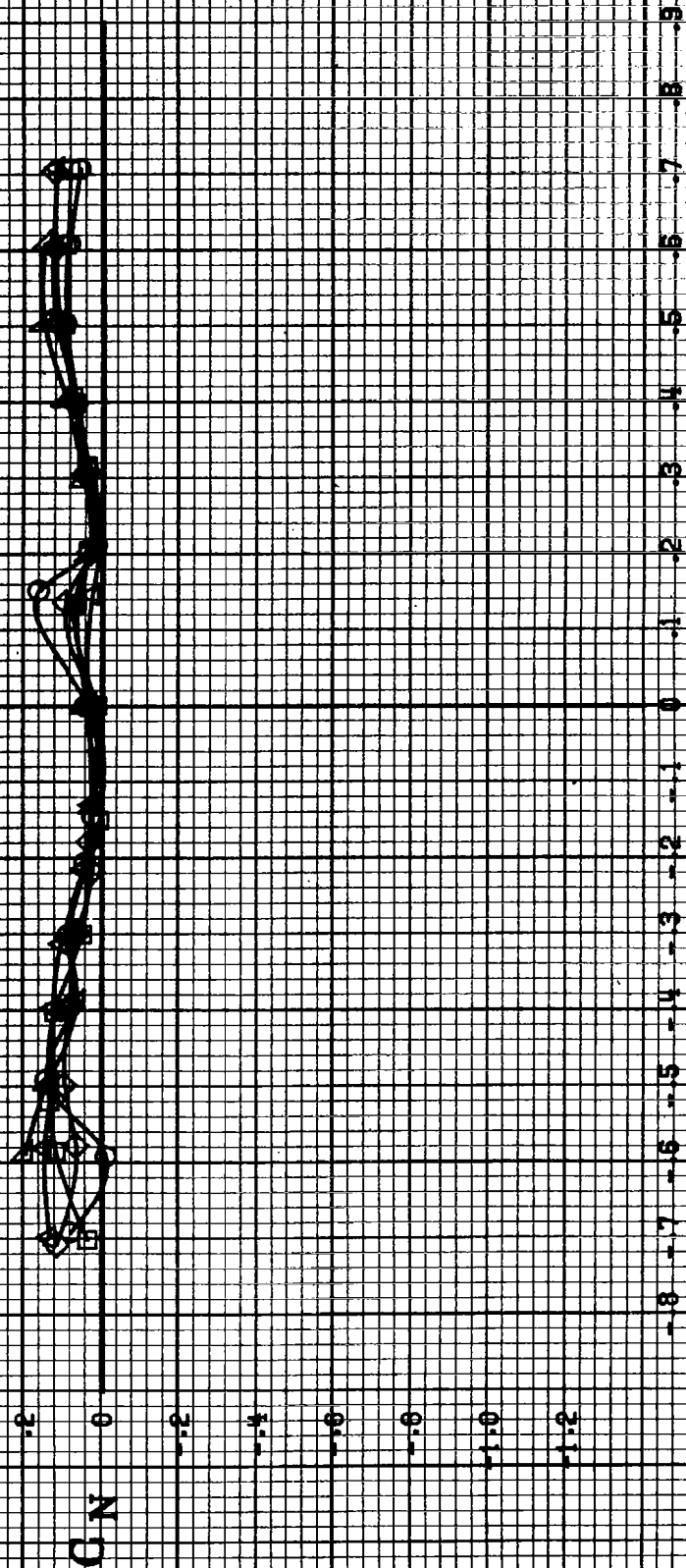
(c)  $\omega = 30 \text{ rad/sec}$ ,  $\delta R = 0$ .  
Figure A117. Continued.



(d)  $\alpha = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A117-Continued.

8468

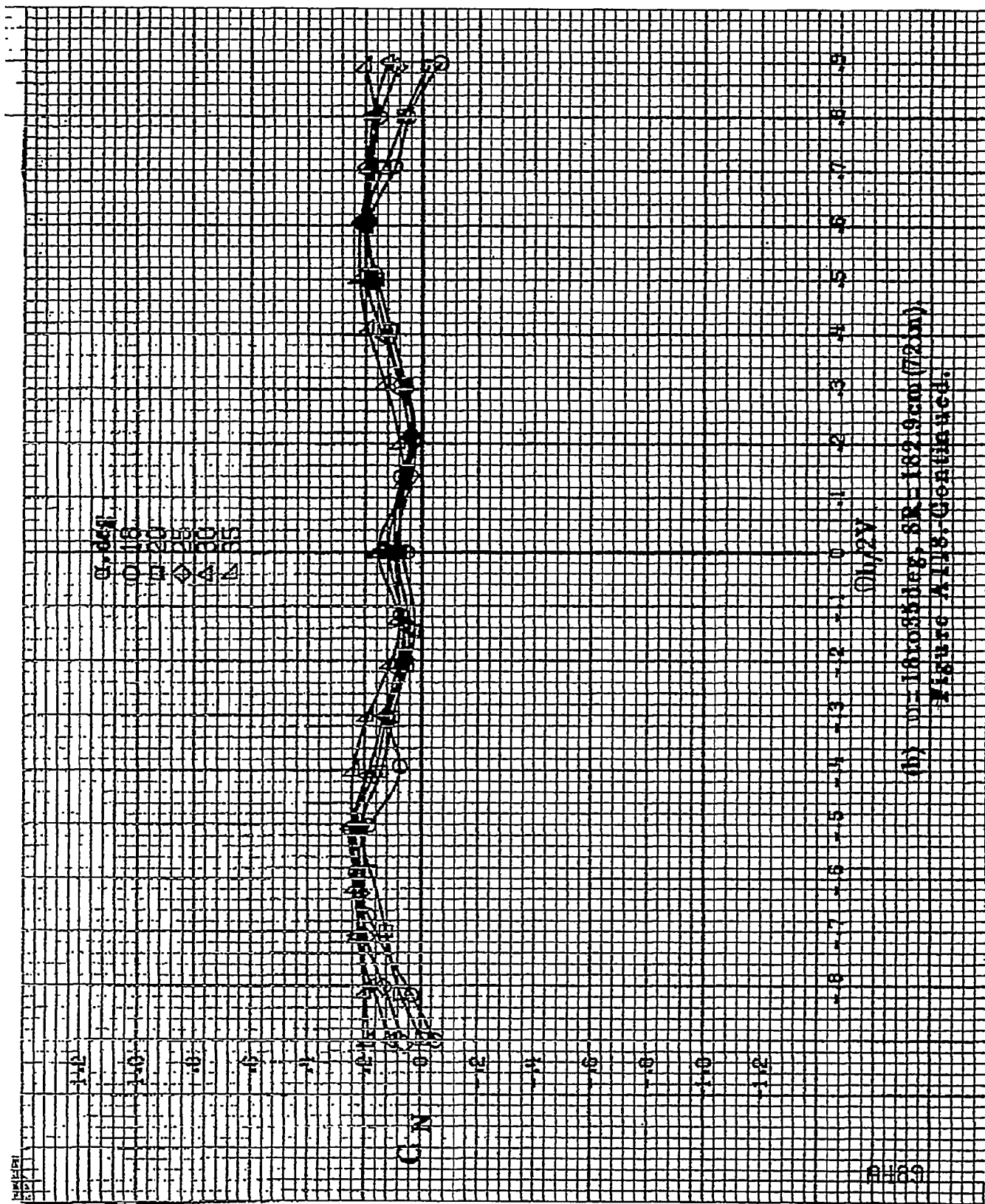
$\alpha$ , deg  
 0 5 10 15 16

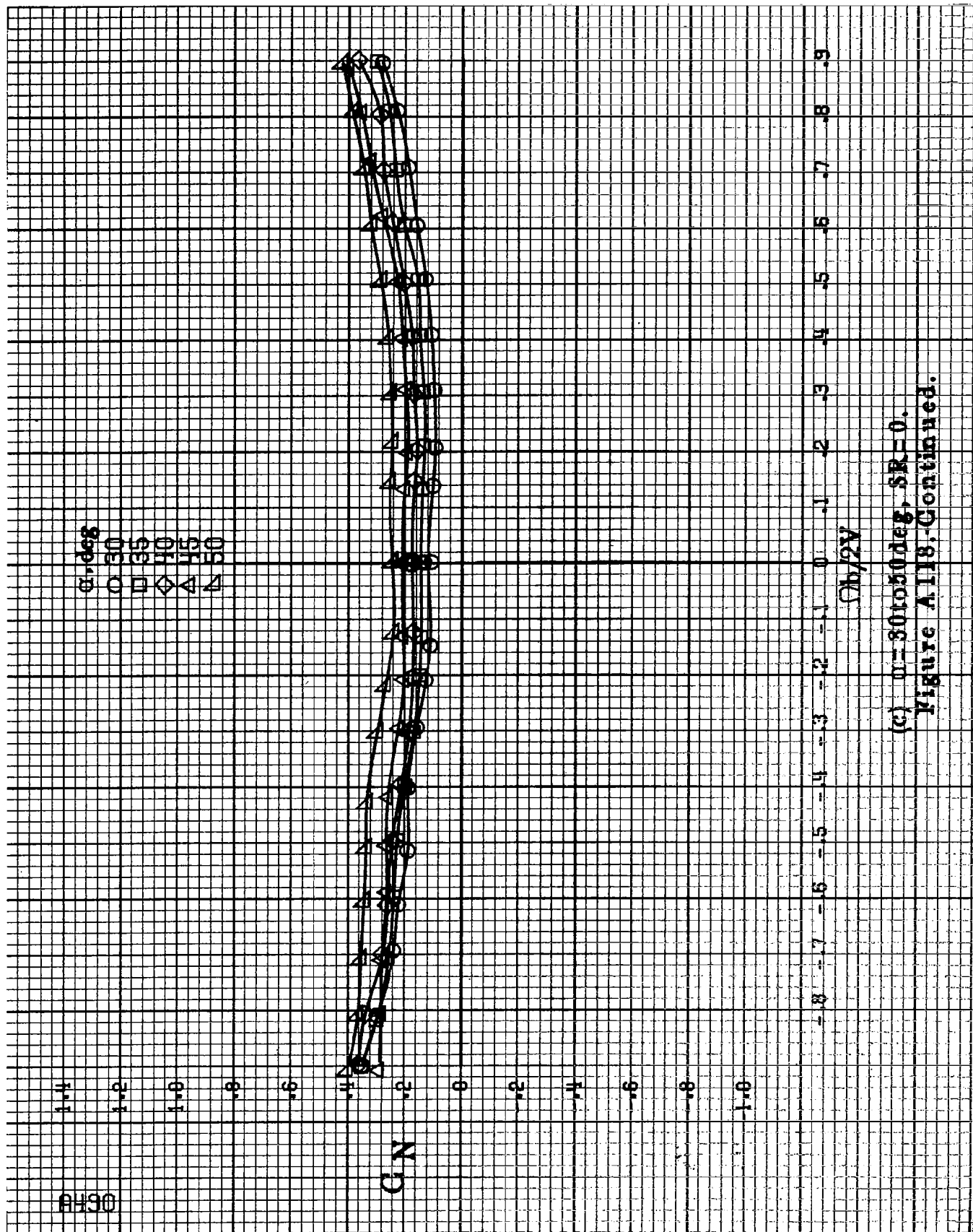


$\alpha$ , deg

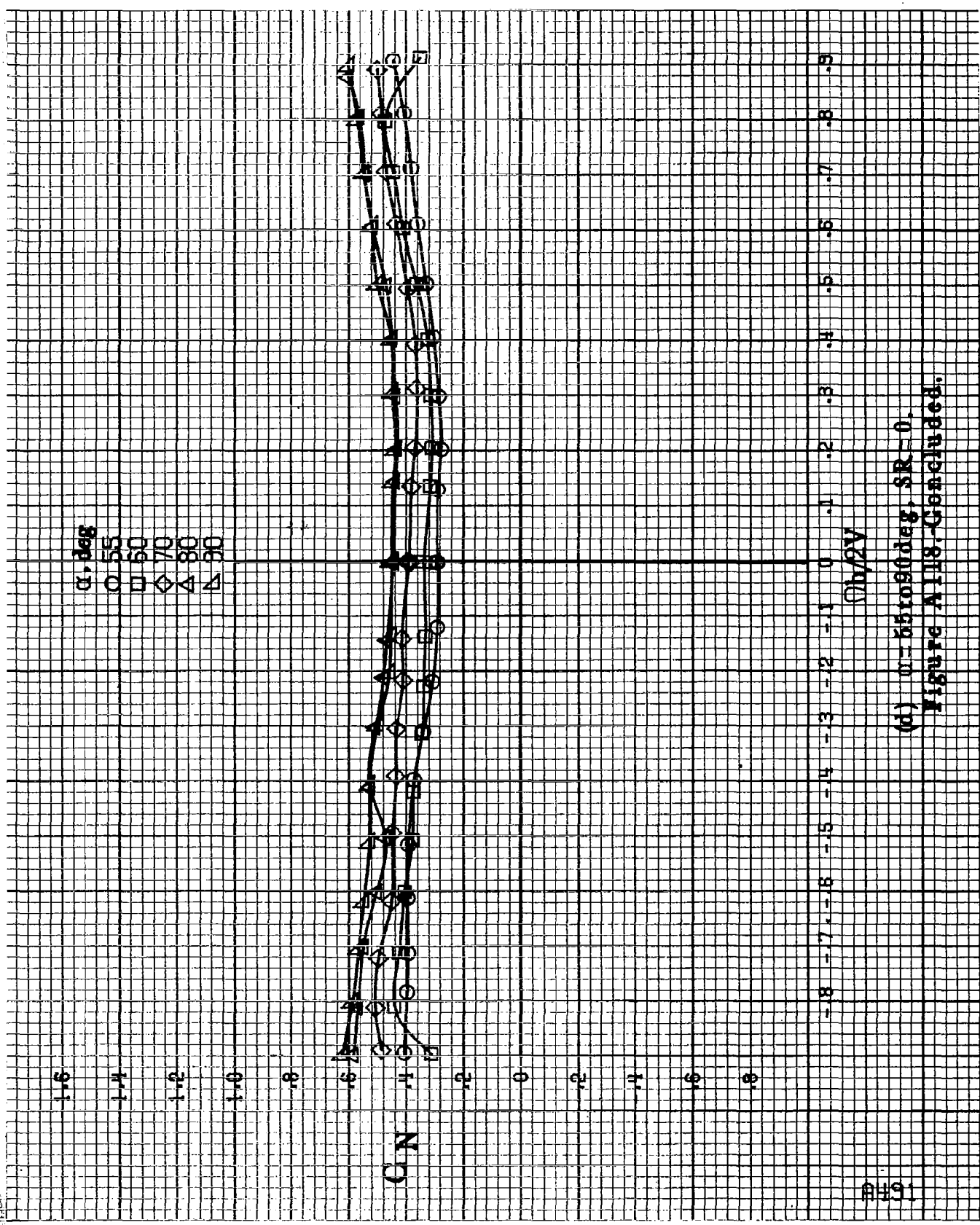
(a)  $\alpha = 8$  to  $16$  deg,  $SR = 182.9$  cm (72 in).

Figure A118.-Effect of rotation rate and angle of attack on normal force coefficient for wing and horizontal tail off configuration.  $\delta_h = 0^\circ$ ,  $\delta_v = 0^\circ$ .





(c)  $\omega = 30 \text{ to } 50 \text{ deg}$ ,  $SR = 0$ .  
Figure A118-Continued.

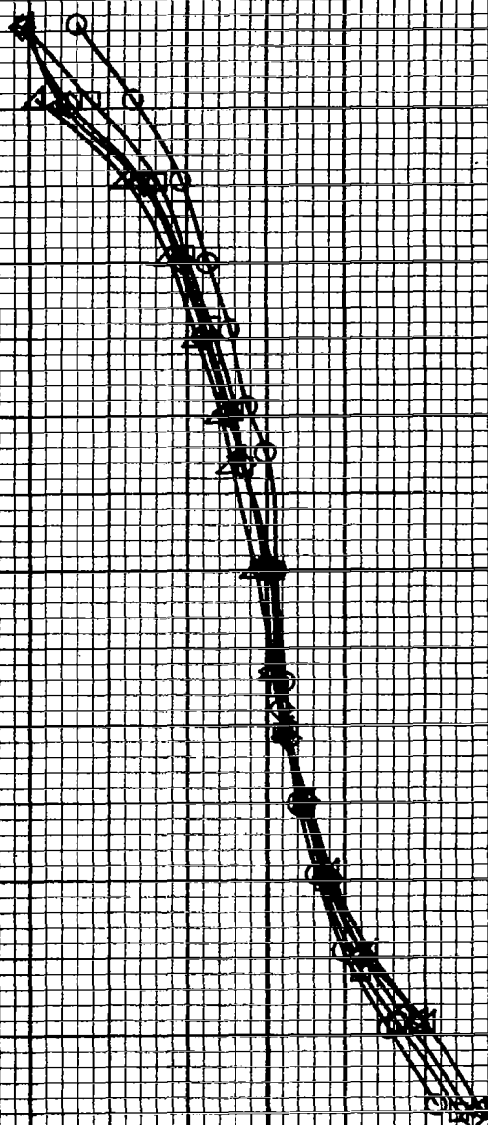


(d)  $\alpha=55$  to  $90$  deg, SR=0.  
Figure A118-Continued.

PH32

$\alpha$ , deg  
 0 8 12 14 16

$C_L$  .8  
 .7  
 .6  
 .5  
 .4  
 .3  
 .2  
 .1  
 0  
 -.1  
 -.2  
 -.3  
 -.4



- .8 - .7 - .6 - .5 - .4 - .3 - .2 - .1 0 .1 .2 .3 .4 .5 .6 .7 .8 .9  
 $h/2V$

(a)  $\alpha = 8$  to  $16$  deg,  $SR = 192.9$  cm (72 in).

Figure A119.-Effect of rotation rate and angle of attack on side-force coefficient for wing and horizontal tail off configuration.  $\delta = 0^\circ$ ,  $\delta = 0^\circ$ .





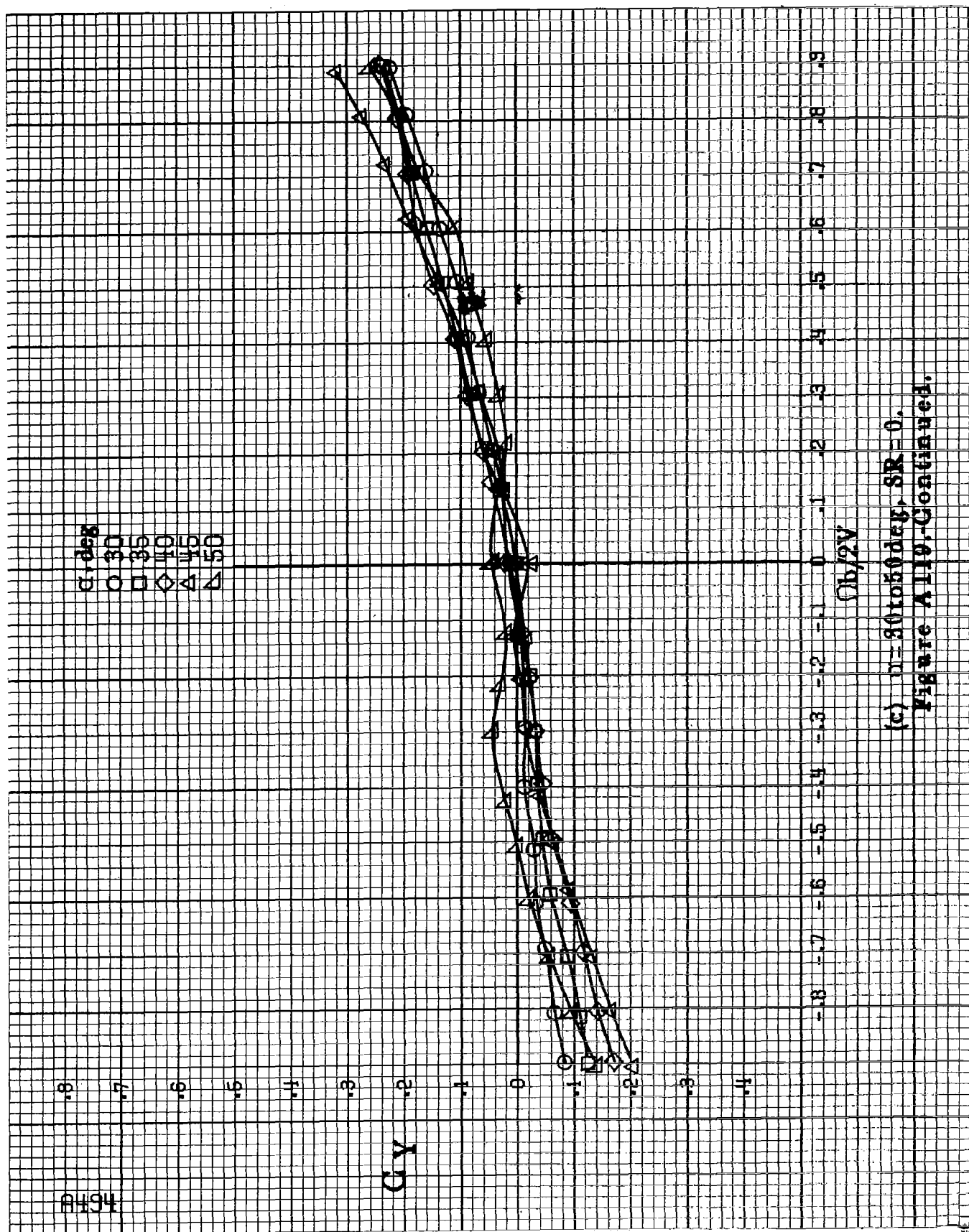
15494

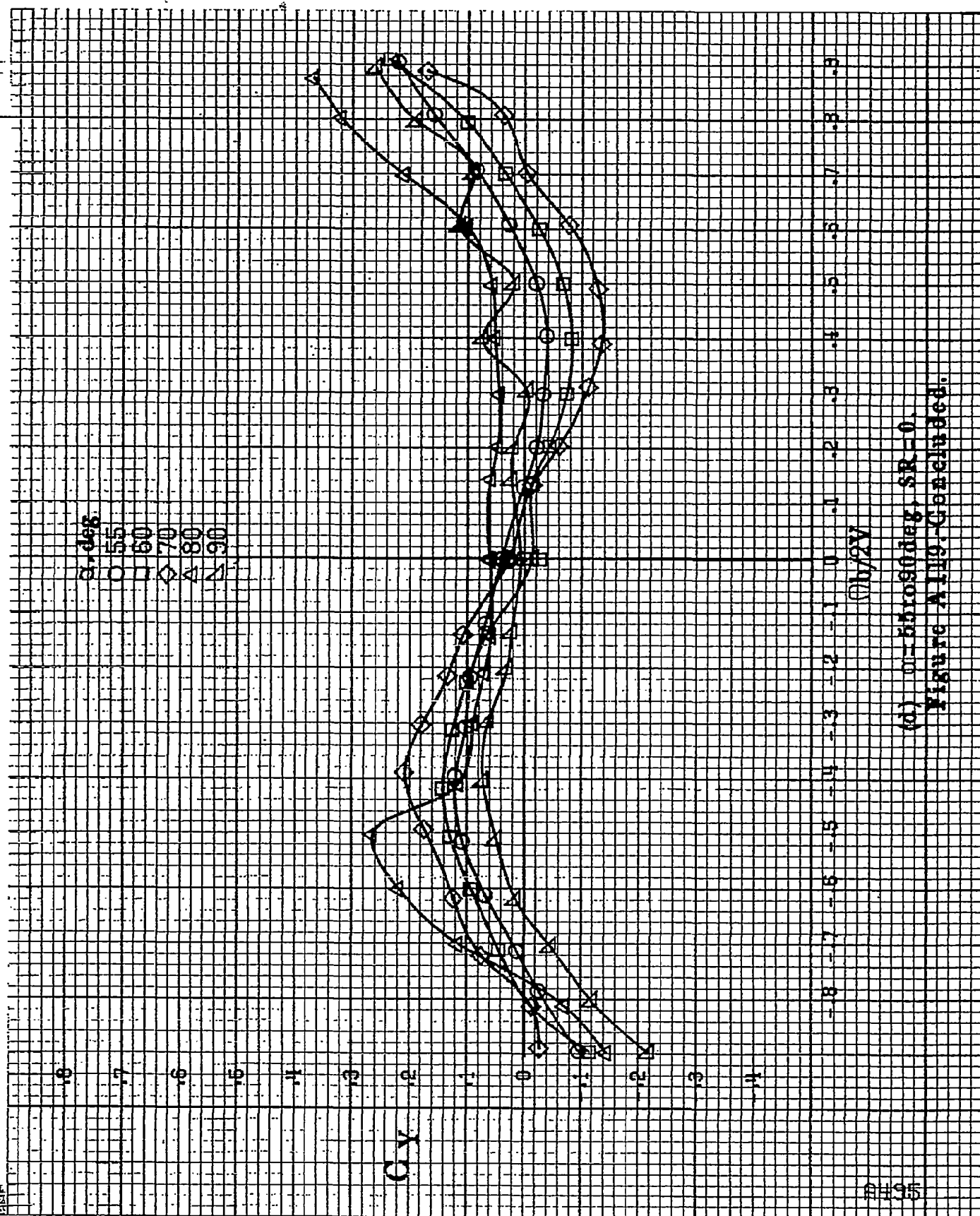
$\alpha$ , deg  
 O 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▲ 50

CY

Ob/2V

(c)  $\eta = 30$  to  $50$  deg,  $SR = 0$ .  
 Figure A119-Continued.





(d)  $\alpha = 55^\circ$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A119. Continued.

8406

$\alpha, \text{deg}$   
 $\alpha = 8$   
 $\alpha = 16$   
 $\alpha = 24$   
 $\alpha = 32$   
 $\alpha = 40$   
 $\alpha = 48$

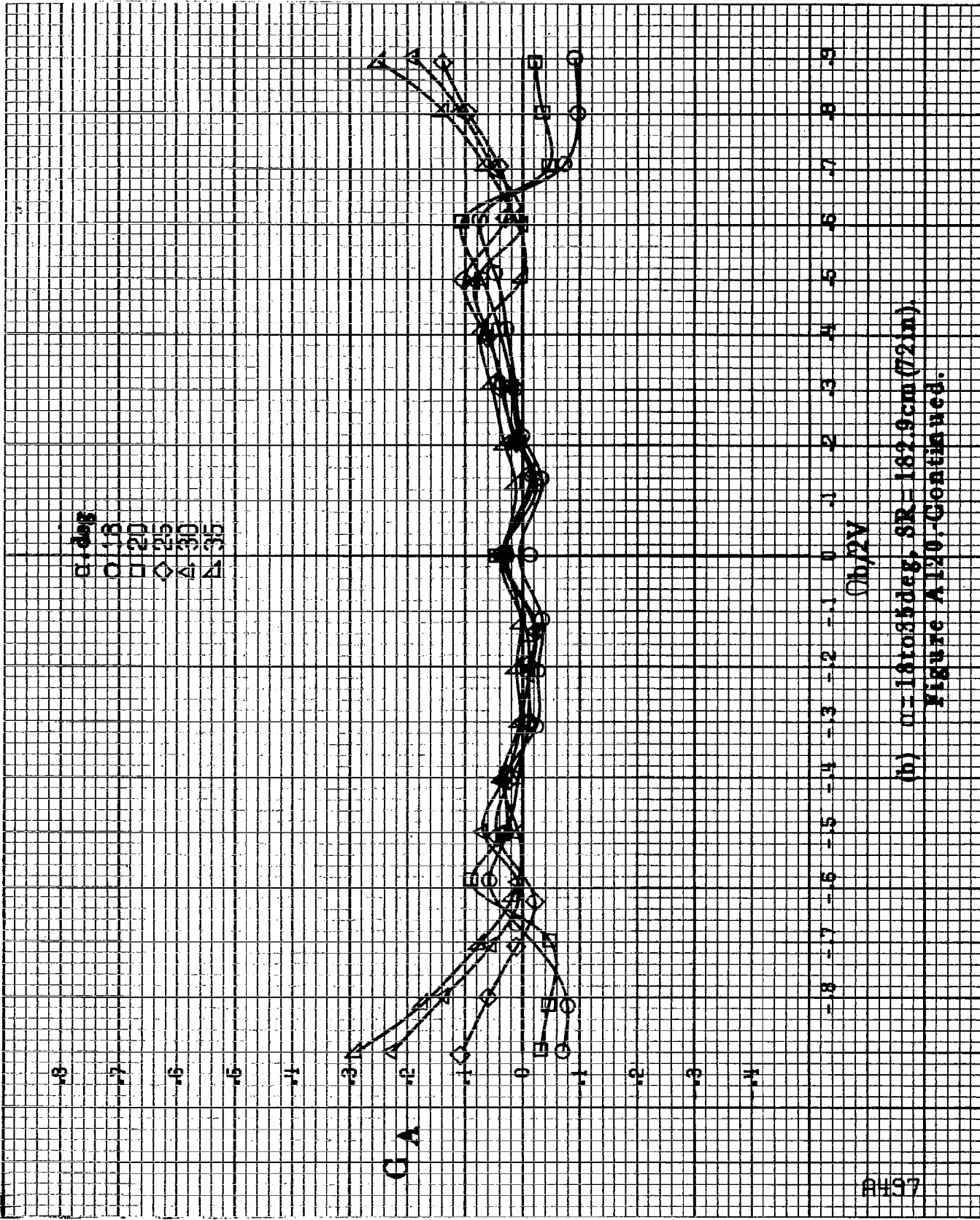
$C_A$



$\alpha, \text{deg}$

(a)  $\alpha = 8$  to  $16 \text{ deg}$ ,  $SR = 182.9 \text{ cm (72 in)}$ .

Figure A120.-Effect of rotation rate and angle of attack on axial-force coefficient for wing and horizontal tail off configuration.  $\delta = 0^\circ$ ,  $\delta = 0^\circ$ ,  $\delta = 0^\circ$ .



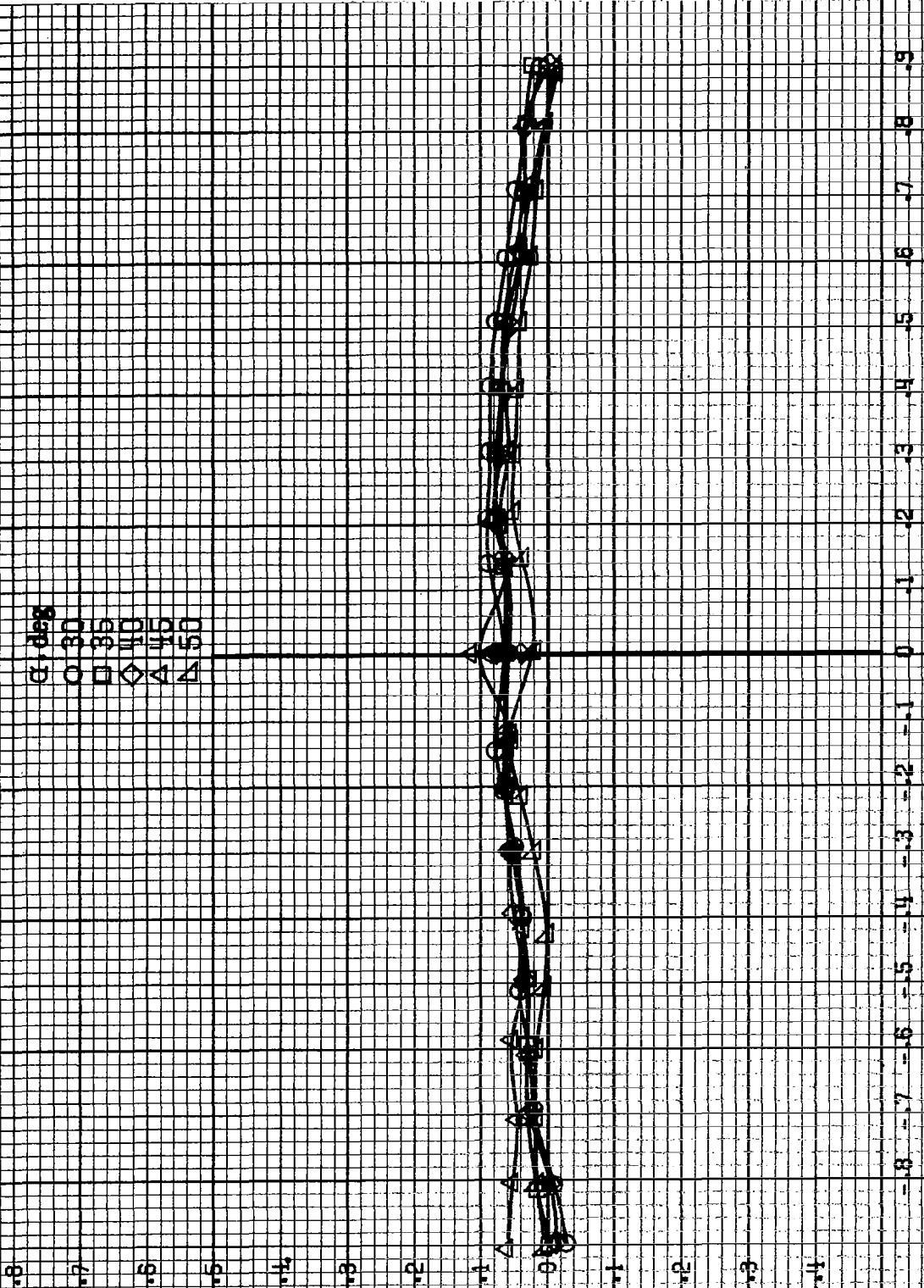
(b)  $\sigma = 1.6 \times 10^8$  dyne/cm<sup>2</sup>, SR = 182.9 cm (72 in).  
Figure A120-Continued.

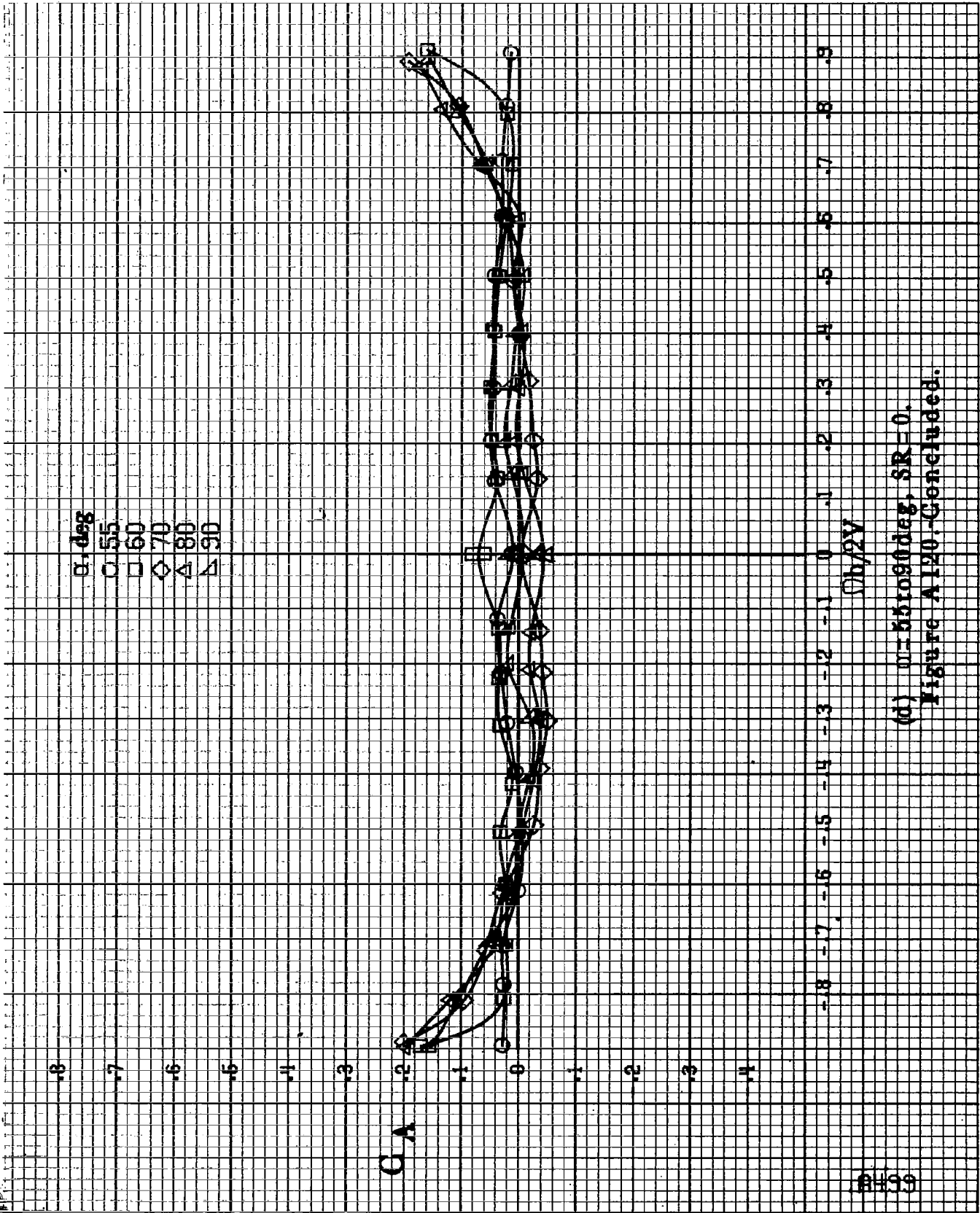
$\alpha$ , deg  
 ○ 30  
 □ 35  
 ◇ 40  
 △ 45

C.A

$\eta$ , 2V

(c)  $\gamma = 30$  to  $50$  deg,  $SR = 0$ .  
 Figure A120-Continued.





(d)  $m=55$  to  $90^\circ$ ,  $SR=0$ .  
Figure A120.-Concluded.

9500

0.005  
0.01  
0.02  
0.03  
0.04  
0.05

$C_n$

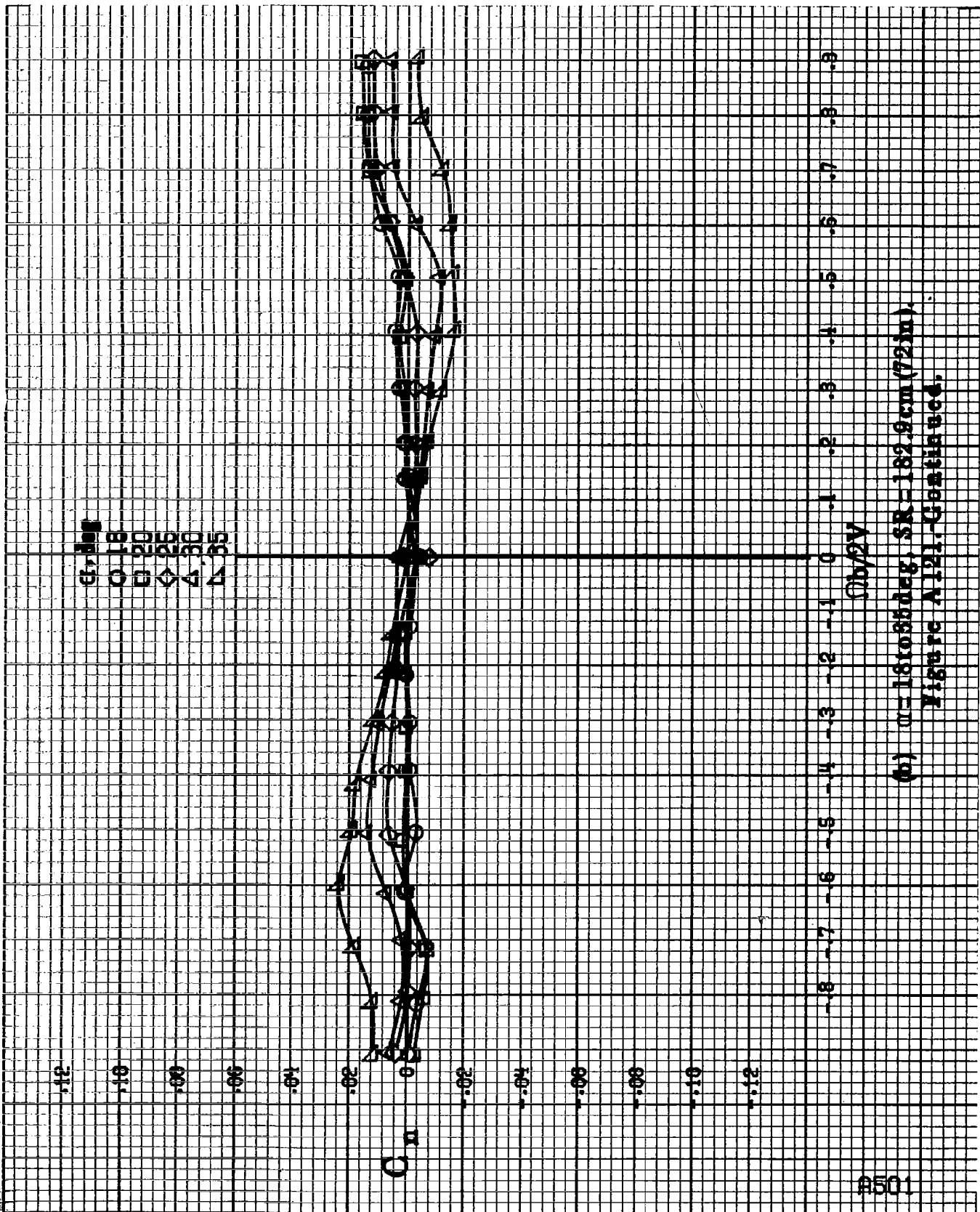
-18 -17 -16 -15 -14 -13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 .1 .2 .3 .4 .5 .6 .7 .8 .9

(b) 2V

(a)  $\alpha = 8$  to  $16$  deg.  $SR = 132.9$  cm (72 in).

Figure A121.-Effect of rotation rate and angle of attack on yawing moment coefficient for wing and vertical tail off configuration.  $\delta_n = 0^\circ$ ,  $\delta_n = 0^\circ$ ,  $\delta_n = 0^\circ$ .





(b)  $\alpha = 18$  to  $35^\circ$ ,  $SR = 182.9 \text{ cm (72 in.)}$   
Figure A121. Continued.

8502

$\alpha$ , deg  
 ○ 30  
 □ 35  
 ◇ 40  
 △ 45



(c)  $\alpha=30$  to  $50$  deg,  $SR=0$ .  
 Figure A121-Continued.

$\alpha$ , deg  
 0 55  
 0 60  
 0 70  
 0 80  
 0 90

C<sub>11</sub>

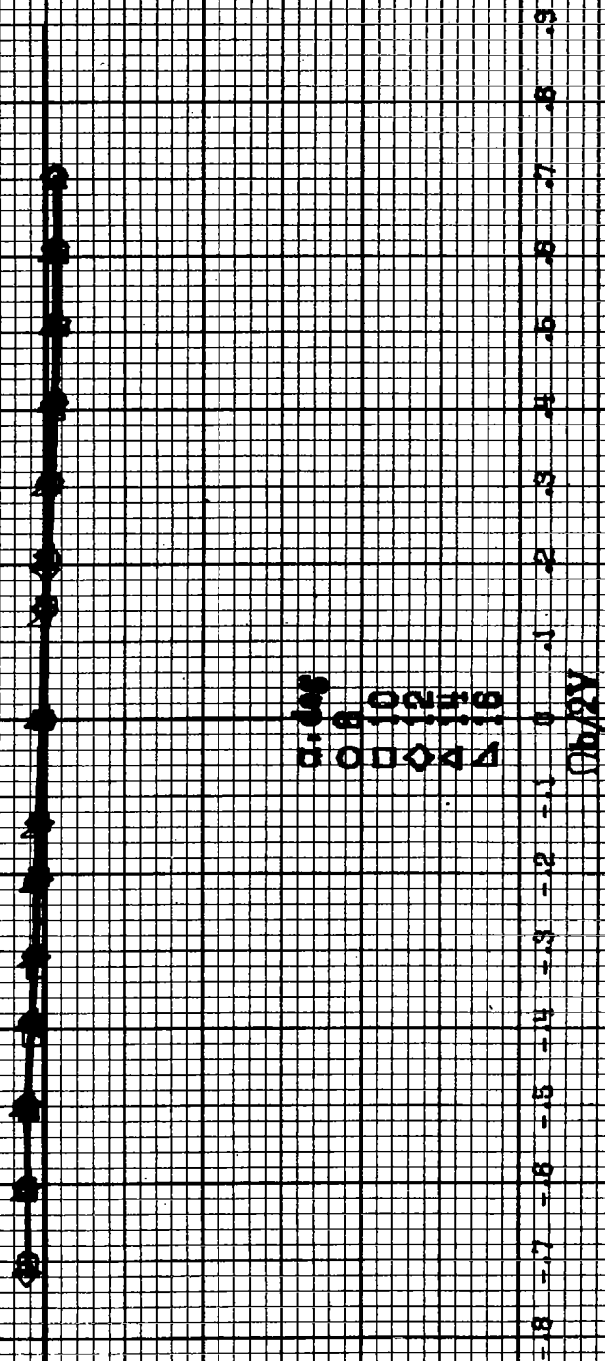
Ob/2V

(d)  $\alpha=55$  to  $90$  deg,  $SR=0$ .  
 Figure A121-Concluded.

9503

8504

$C_L$



(a)  $\alpha = 8$  to  $18$  deg,  $SR = 132.3$  cm (72 in).

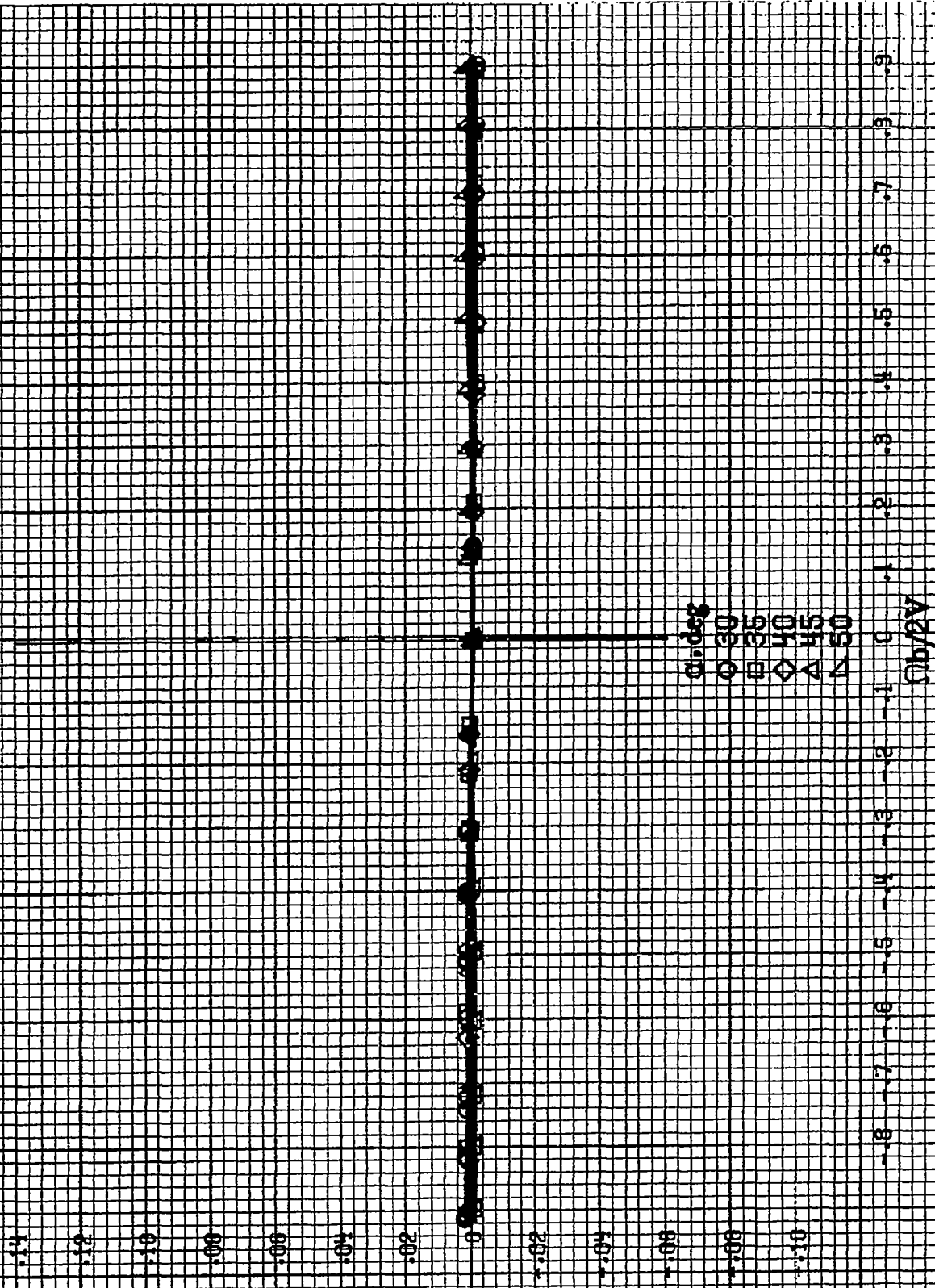
Figure A122.-Effect of notation rate and angle of attack on rolling-moment coefficient for wing and vertical tail off configuration.  $\delta_r = 0^\circ$ ,  $\delta_v = 0^\circ$ .



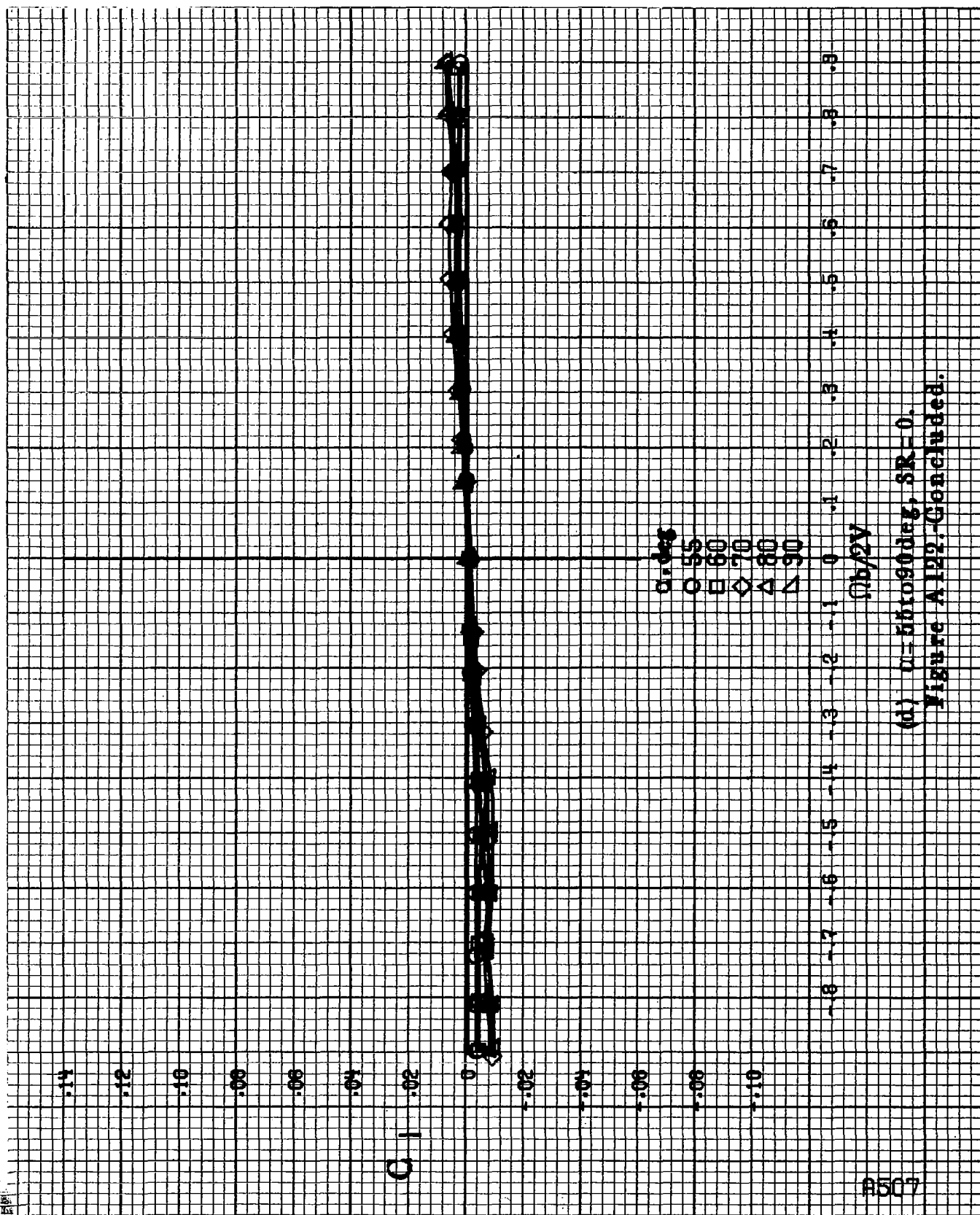
(b)  $\alpha = 16$  to  $35$  deg, SR = 182.9 cm (72 in).  
Figure A122-Continued.

A506

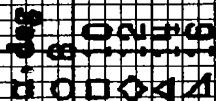
C



(c)  $\alpha = 30$  to  $50^\circ$ ,  $SR = 0$ .  
Figure A122-Continued.

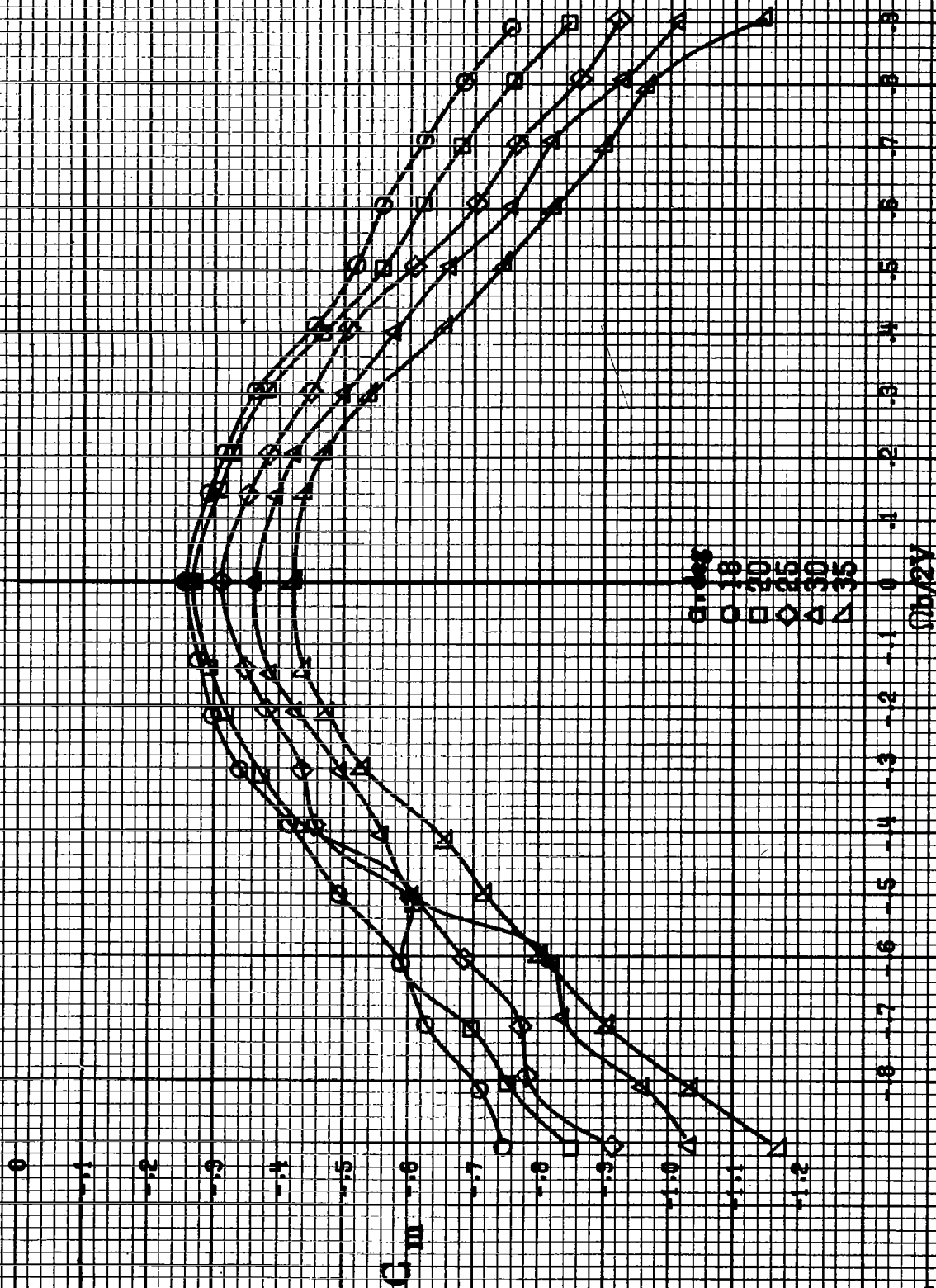


(d)  $\alpha = 55$  to  $90$  deg,  $SR = 0$ .  
Figure A122: Concluded.



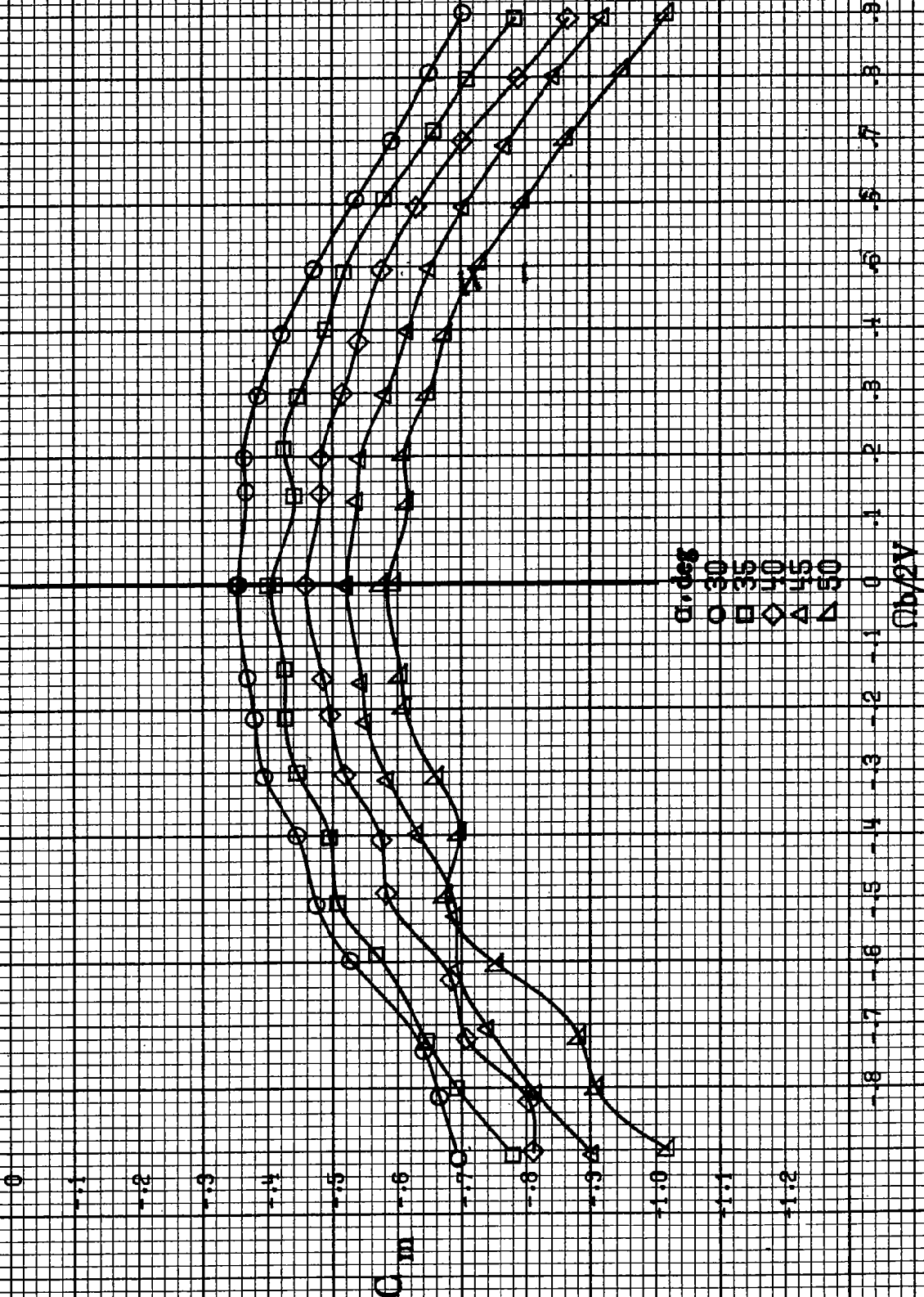
(a)  $\alpha = 8^\circ$  to  $16^\circ$  deg.,  $SR = 132.9$  cm (794 in.).



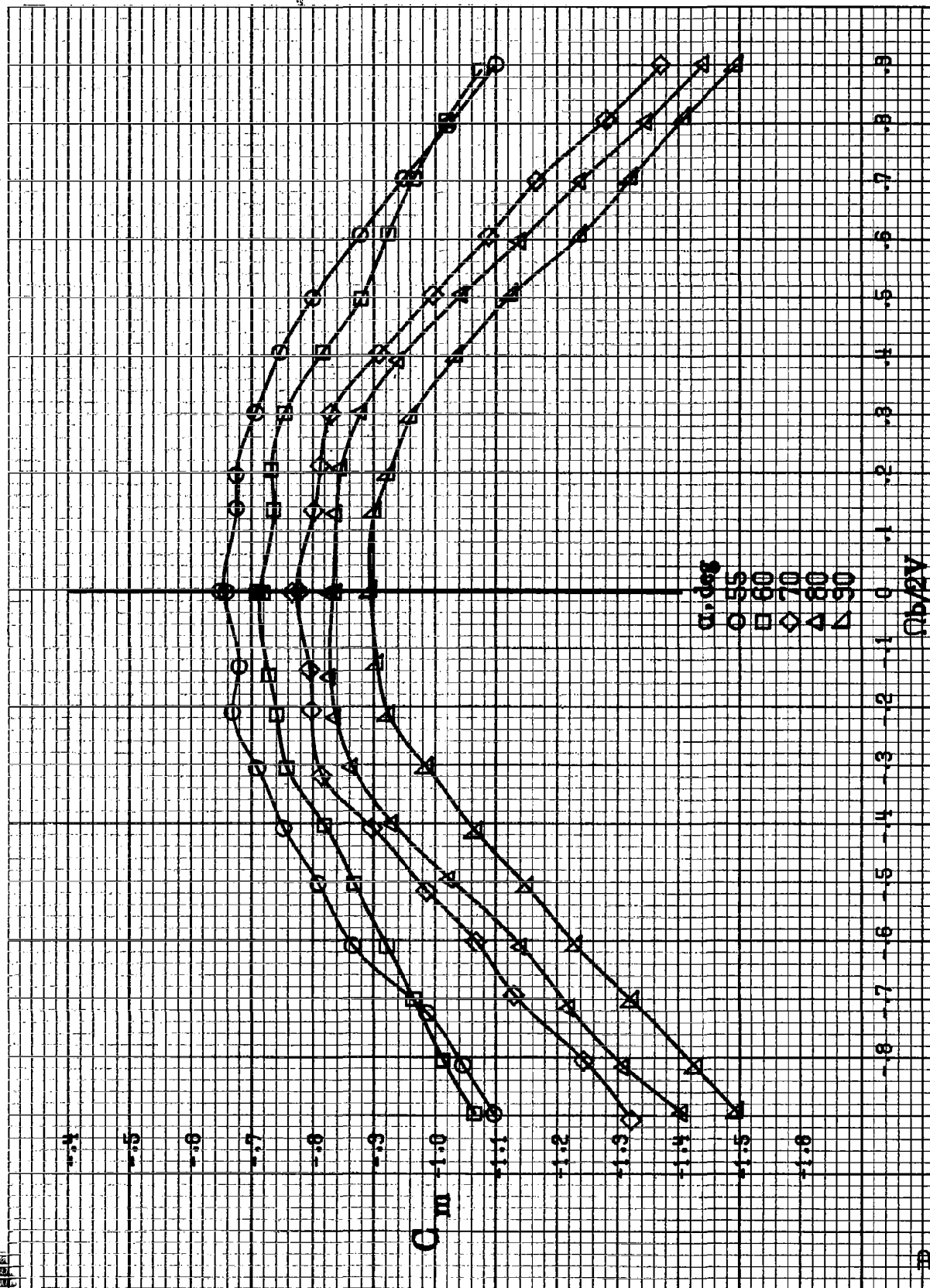


(b)  $\mu = 180.55 \text{ deg}$ ,  $SR = 162.9 \text{ cm (72 in)}$ .  
Figure A128-Continued.

#510



(c)  $\alpha = 30$  to  $50$  deg,  $SR = 0$ .  
Figure A128.-Continued.



(d)  $\alpha = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A128. Concluded.

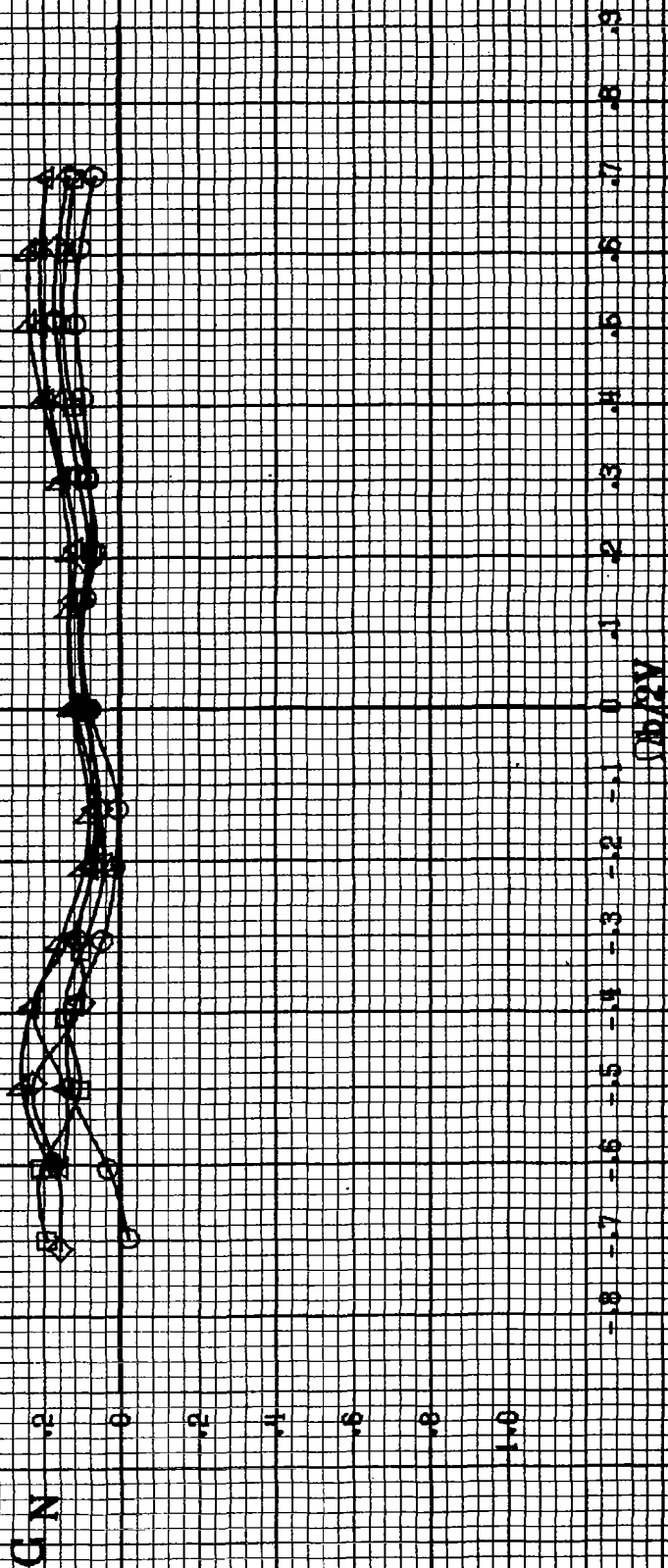
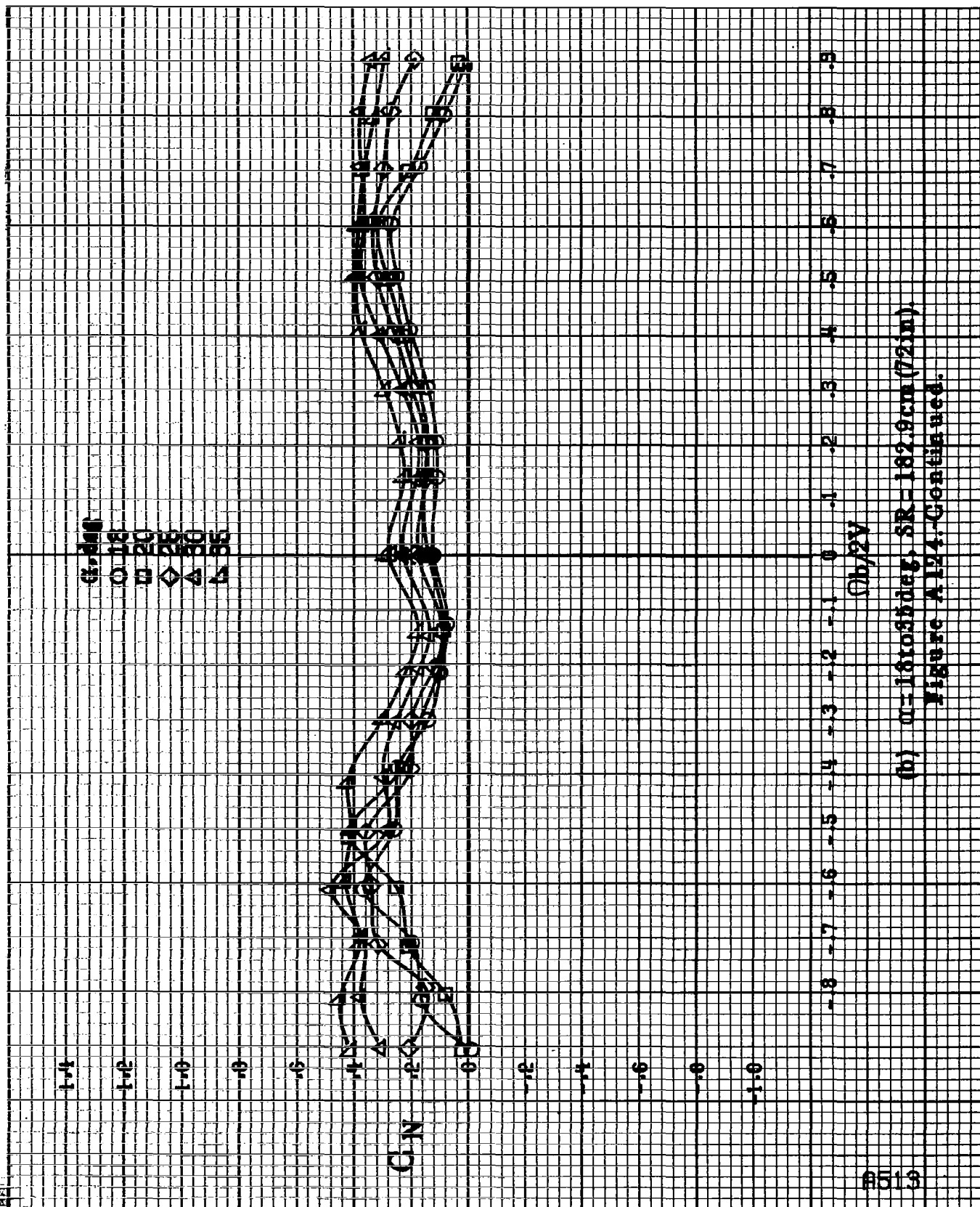


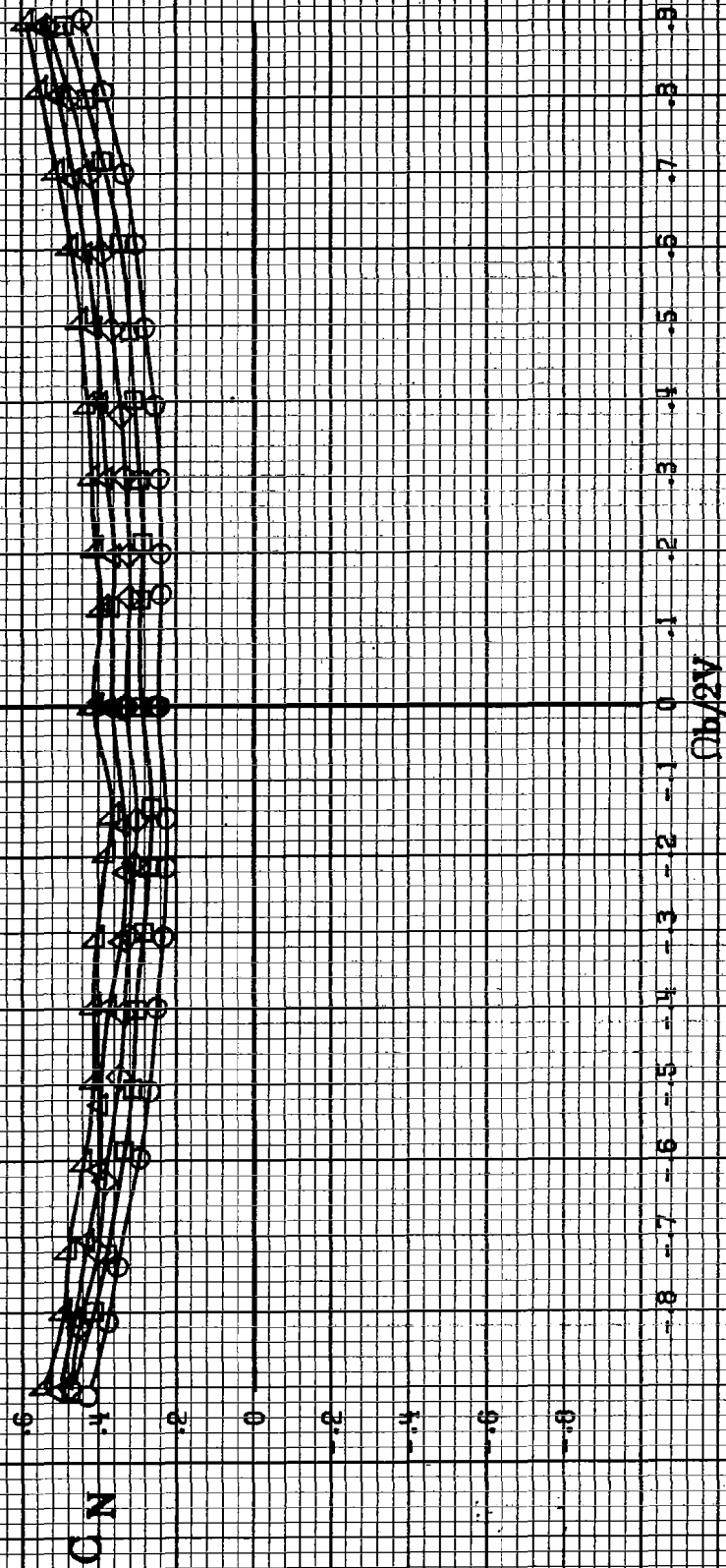
Figure A 124-Effect of rotation rate and angle of attack on normal-force coefficient for wing and vertical tail off configuration.  $\delta\alpha = 1^\circ$ ,  $\delta\alpha = 0^\circ$ ,  $\delta\alpha = -0.5^\circ$ ,  $\beta = 0^\circ$ .



(b)  $\alpha=18.055\text{deg}$ ,  $SR=182.9\text{cm}$  (72in).  
Figure A124. Continued.

8514

$\alpha_{1.668}$   
 $\alpha_{1.60}$   
 $\alpha_{1.55}$   
 $\alpha_{1.50}$   
 $\alpha_{1.45}$   
 $\alpha_{1.40}$



(c)  $\alpha = 30$  to  $50$  deg,  $SR = 0$ .  
 Figure A124-Continued.

$\theta$ , deg  
 ○ 55  
 □ 60  
 ◇ 70  
 △ 80  
 ▽ 90

1.0  
 1.6  
 1.4  
 1.2  
 1.0  
 .8  
 .6  
 .4  
 .2  
 0  
 -.2  
 -.4  
 -.6

CN

$\Omega b/2V$

-.8  
 -.7  
 -.6  
 -.5  
 -.4  
 -.3  
 -.2  
 -.1  
 0  
 .1  
 .2  
 .3  
 .4  
 .5  
 .6  
 .7  
 .8  
 .9

(d)  $\Omega = 880$  to  $90$  deg,  $SR = 0$ .  
 Figure A124-Continued.

55/55

8516

0.005  
0.01  
0.02  
0.03  
0.04  
0.05

$C_L$

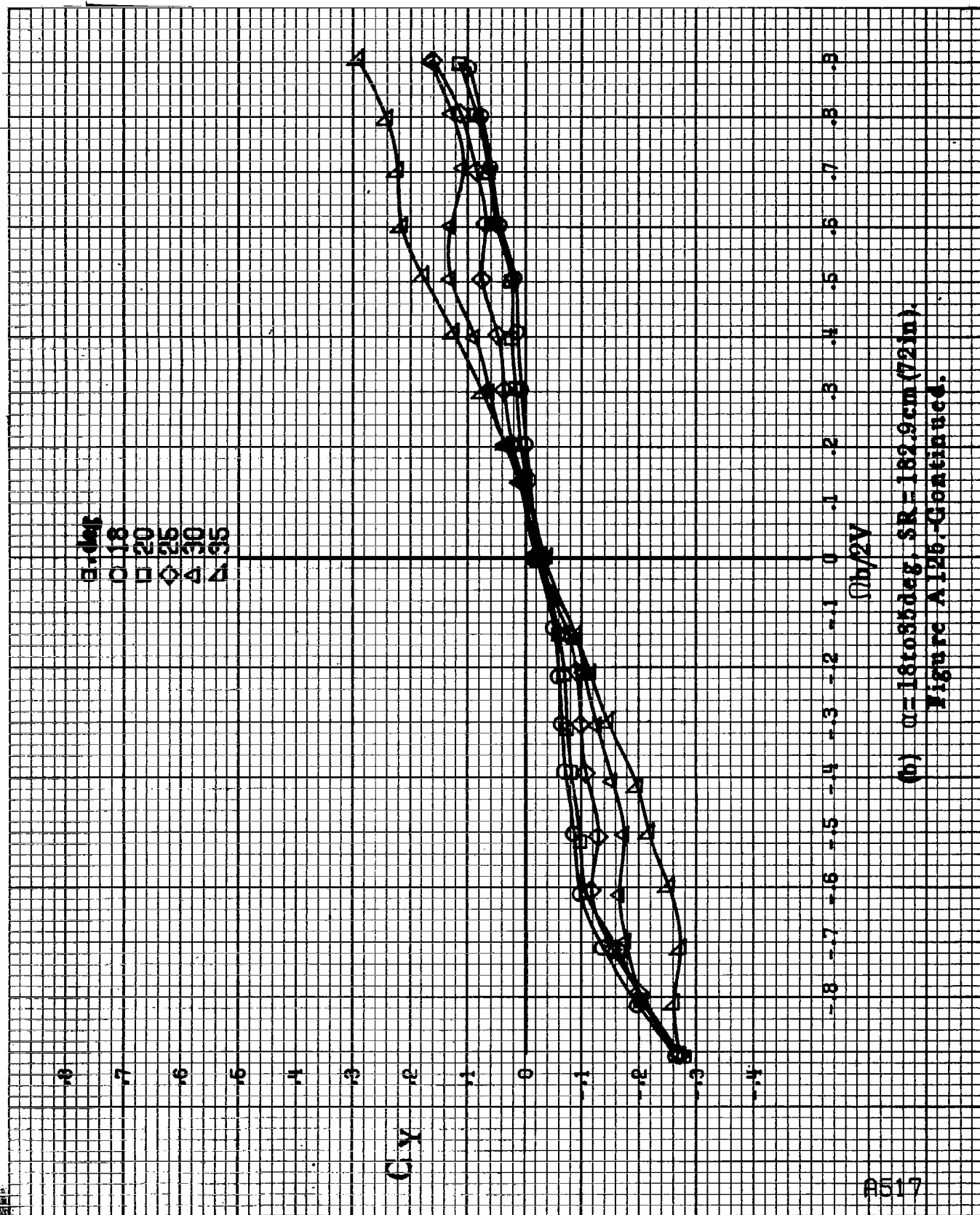
-0.8 -0.7 -0.6 -0.5 -0.4 -0.3 -0.2 -0.1 0 .1 .2 .3 .4 .5 .6 .7 .8 .9

$b/\rho V$

(a)  $\alpha = 8.40164^\circ$ ,  $SR = 182.9 \text{ cm}^2/25\text{ft}^2$ .

Figure A125--Effect of rotation rate and angle of attack on lift-force coefficient for wing and vertical tail off configuration.  $\delta_1 = 0^\circ$ ,  $\delta_2 = 0^\circ$ ,  $\delta_3 = 0^\circ$ .





(b)  $\theta = 18$  to  $35^\circ$ ,  $SR = 182.9 \text{ cm (72 in.)}$ .  
Figure A125-Continued.

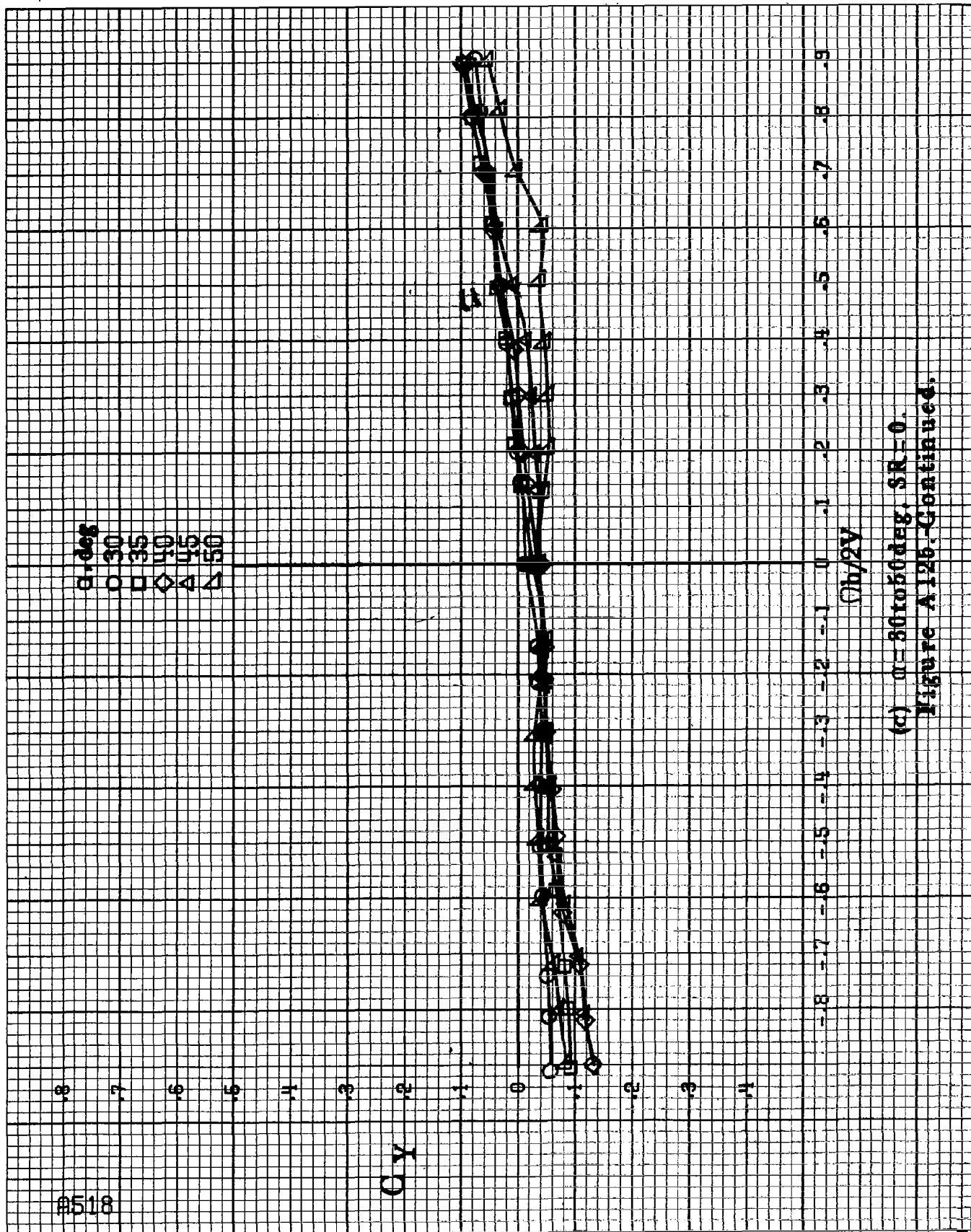
8518

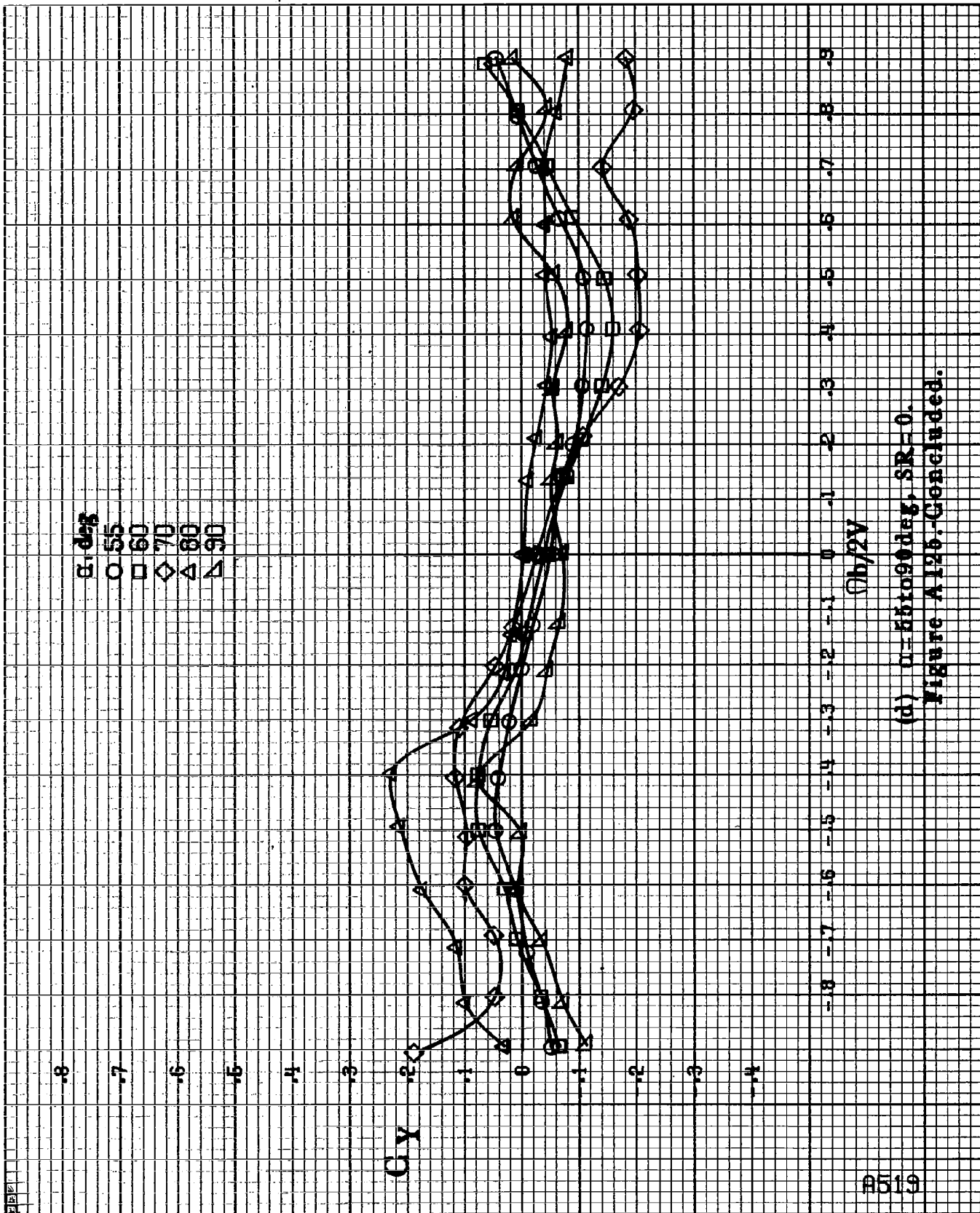
9.0deg  
 O 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▽ 50

$C_y$

$C_{b/2V}$

(c)  $\alpha = 30$  to  $50$  deg,  $SR = 0$ .  
 Figure A126-Continued.





(d)  $\alpha = 55$  to  $90$  deg,  $SR = 0$ .  
Figure A125. Concluded.

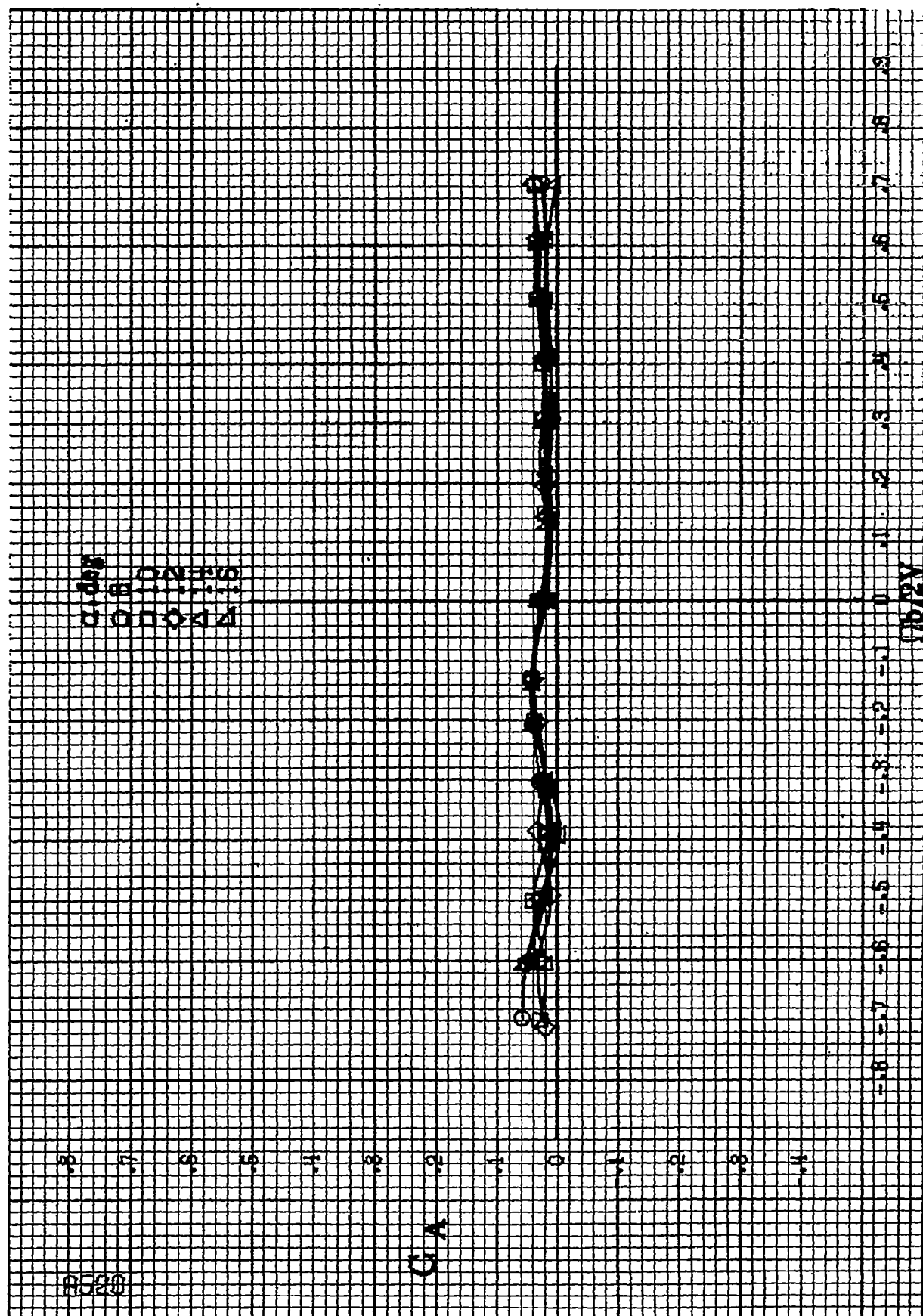
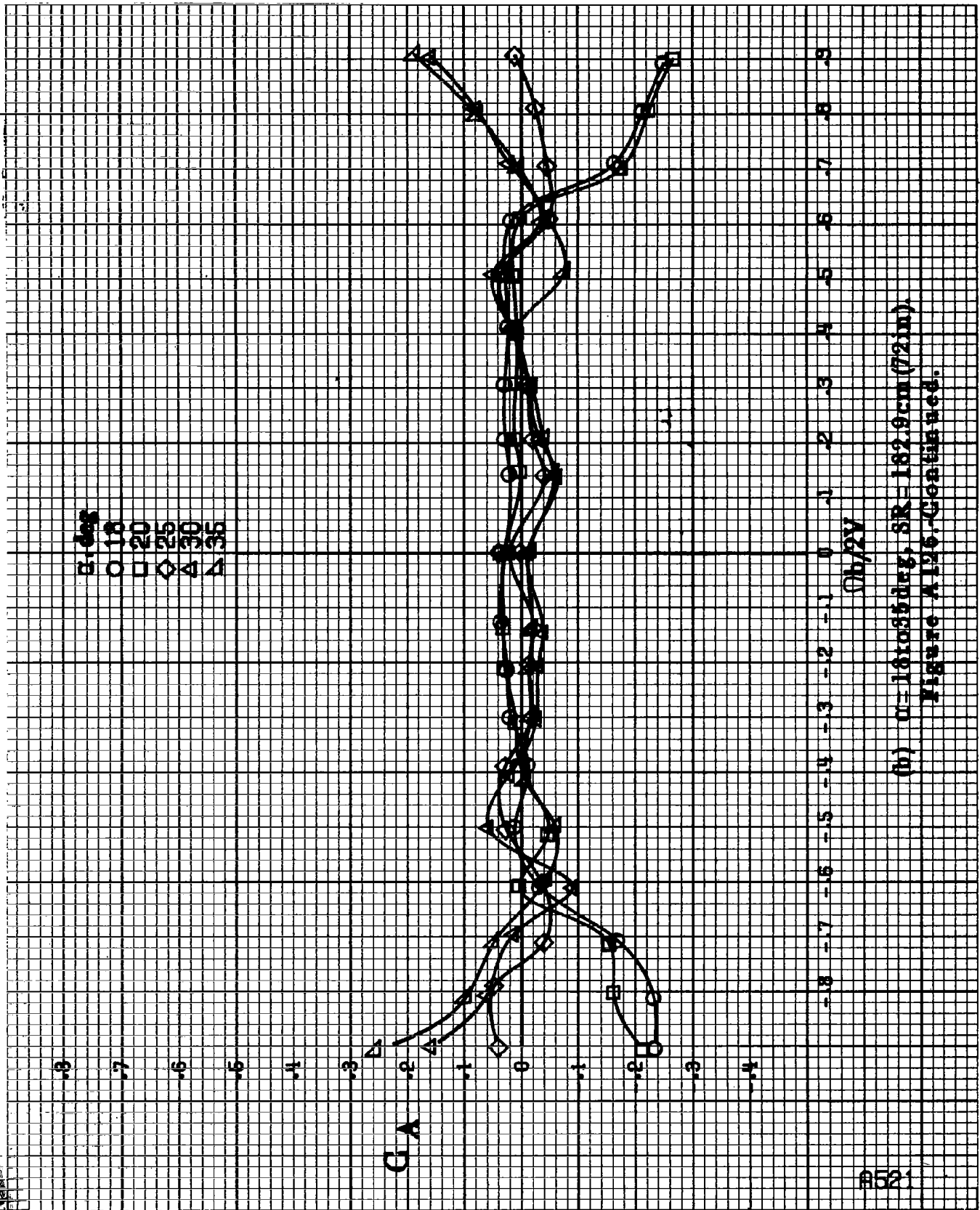


Figure A126-Effect of rotation rate and angle of attack on axial force coefficient for wing and vertical tail off combination.  $\alpha = 840^\circ$ ,  $\beta = 0^\circ$ ,  $\delta = 0^\circ$ ,  $\delta_1 = 0^\circ$ ,  $\delta_2 = 0^\circ$ .



(b)  $\mu = 181055 \text{ deg}$ ,  $SR = 182.9 \text{ cm (72 in)}$   
 Figure A125-Continued.

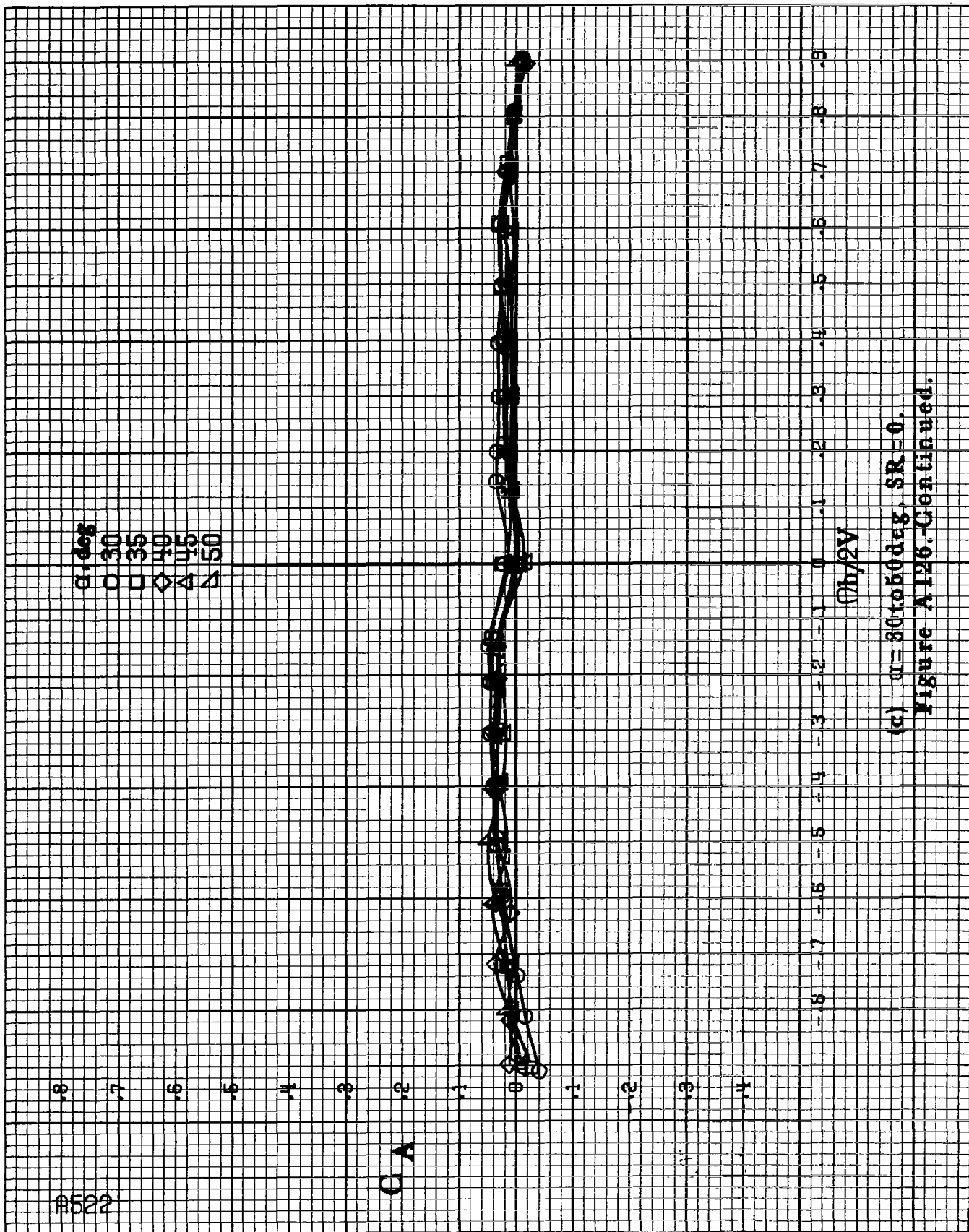
#522

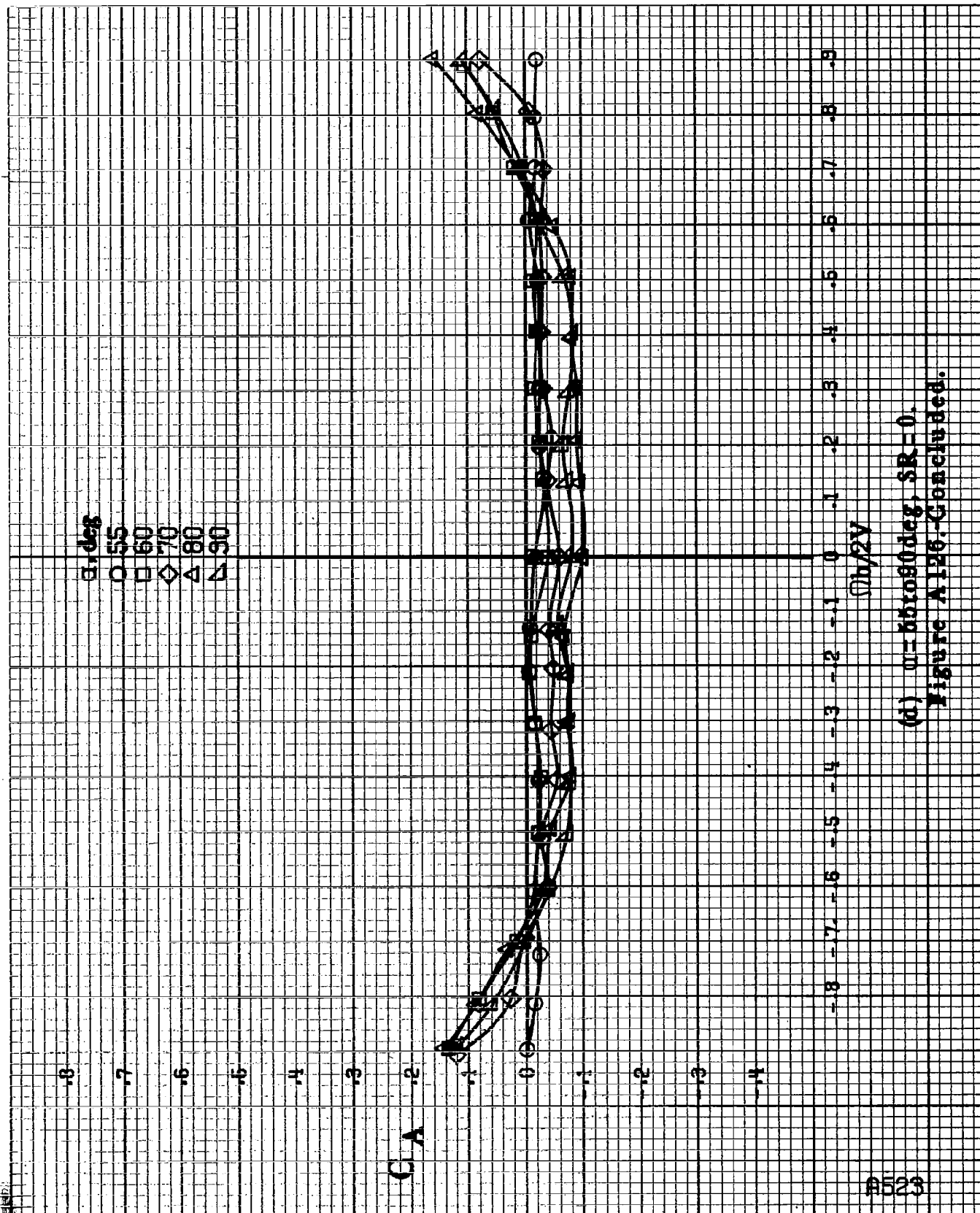
$\alpha$ , deg  
 ○ 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▽ 50

CA

$\phi h/2V$

(a)  $\alpha = 30$  to  $50$  deg,  $SR = 0$ .  
 Figure A126, Continued.



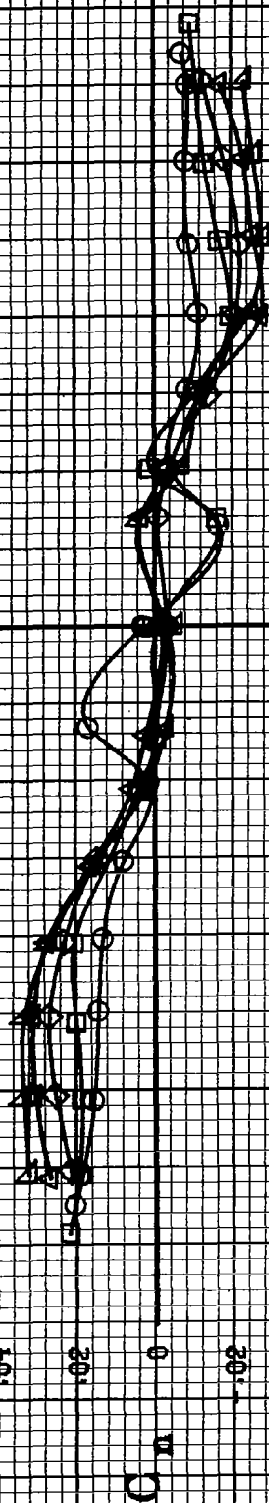


(d)  $\alpha = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A126-Concluded.

8524

$\alpha$ , deg

○ 8  
□ 10  
◇ 12  
△ 14  
▽ 16

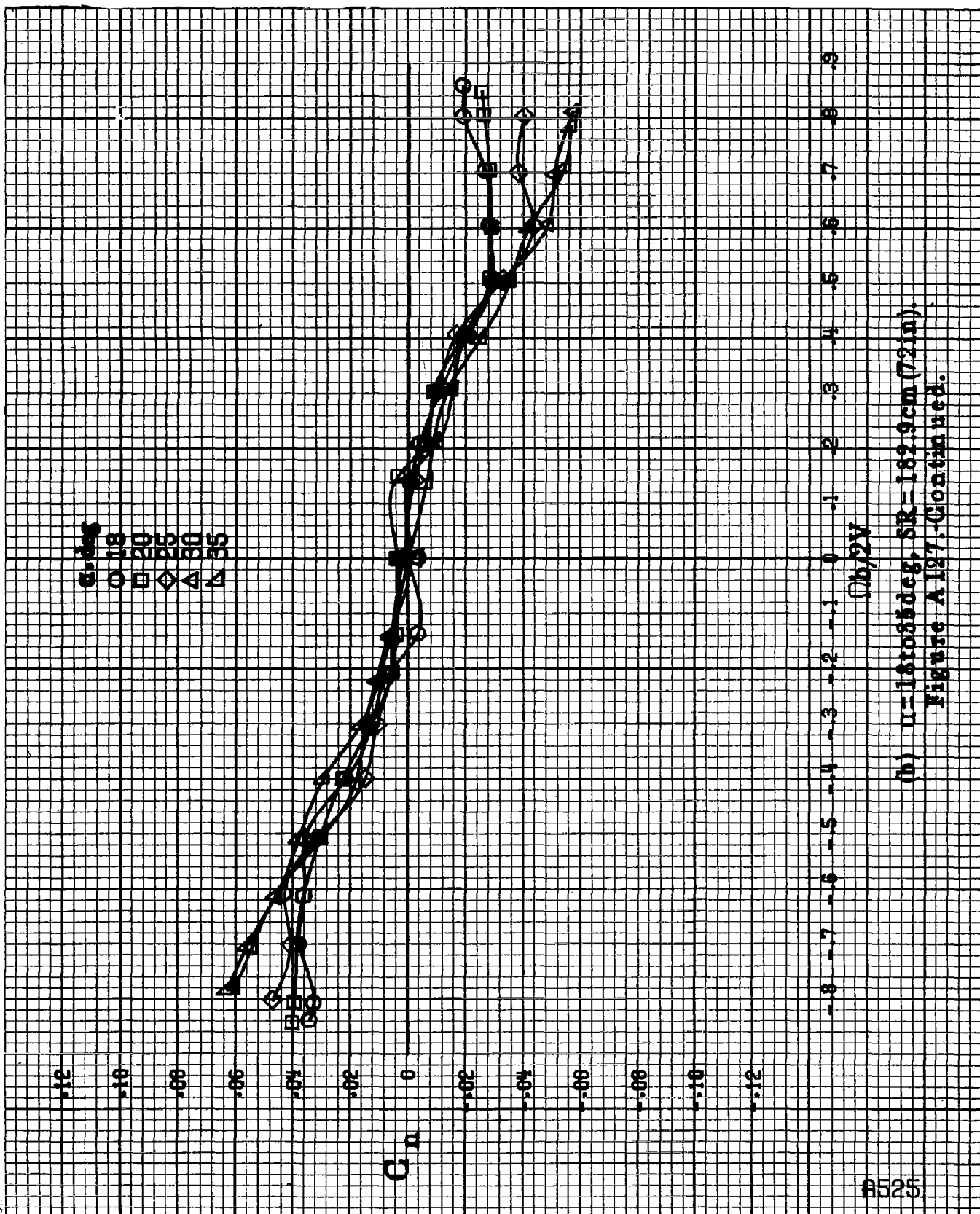


$\beta$ , deg

(a)  $\alpha = 8$  to  $16$  deg,  $SR = 182.9$  cm (72 in).

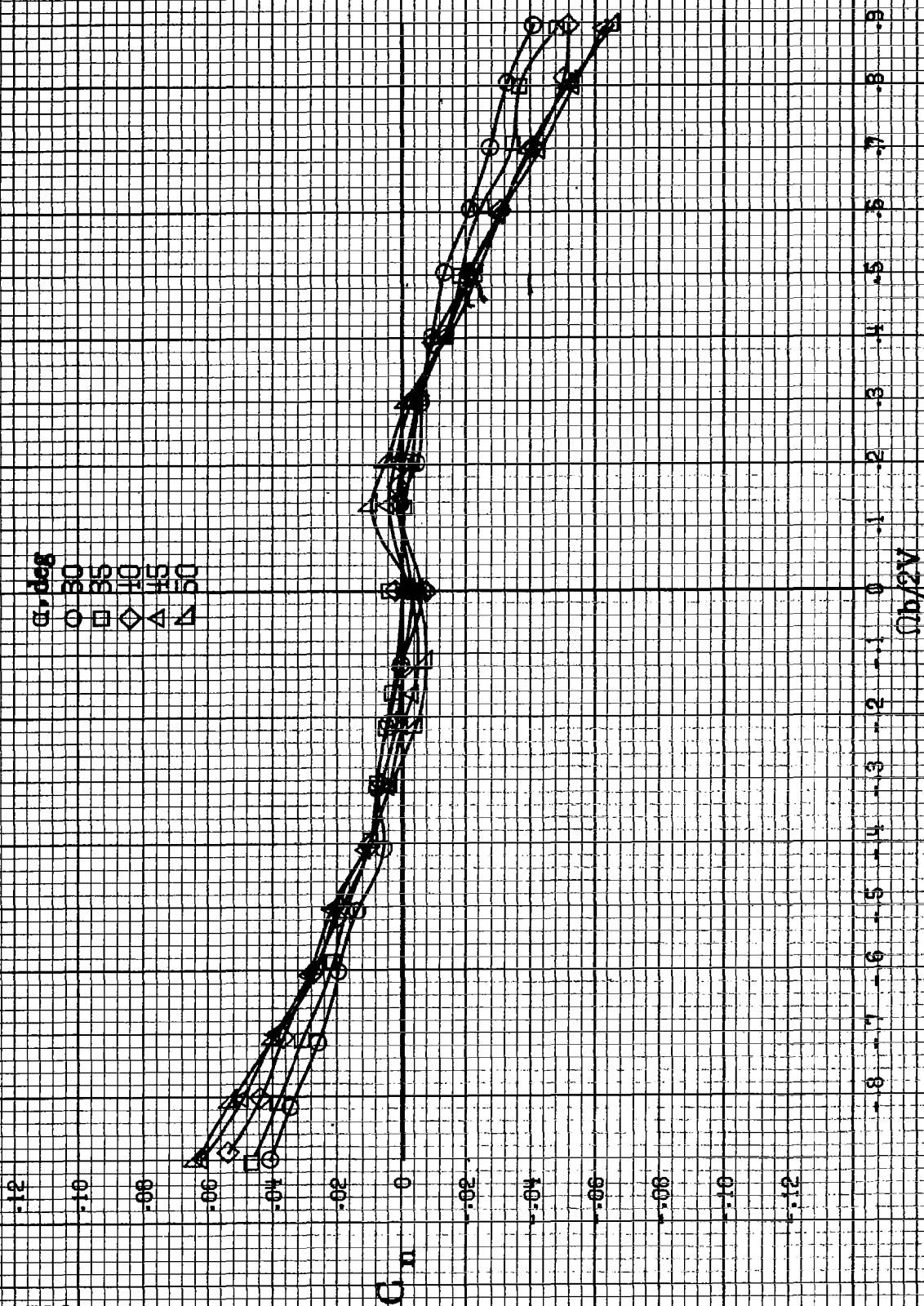
Figure A127.-Effect of rotation rate and angle of attack on yawing moment coefficient for dorsal fin off configuration.  $\delta_a = 0^\circ$ ,  $\delta_r = 0^\circ$ ,  $\delta = 0^\circ$ .



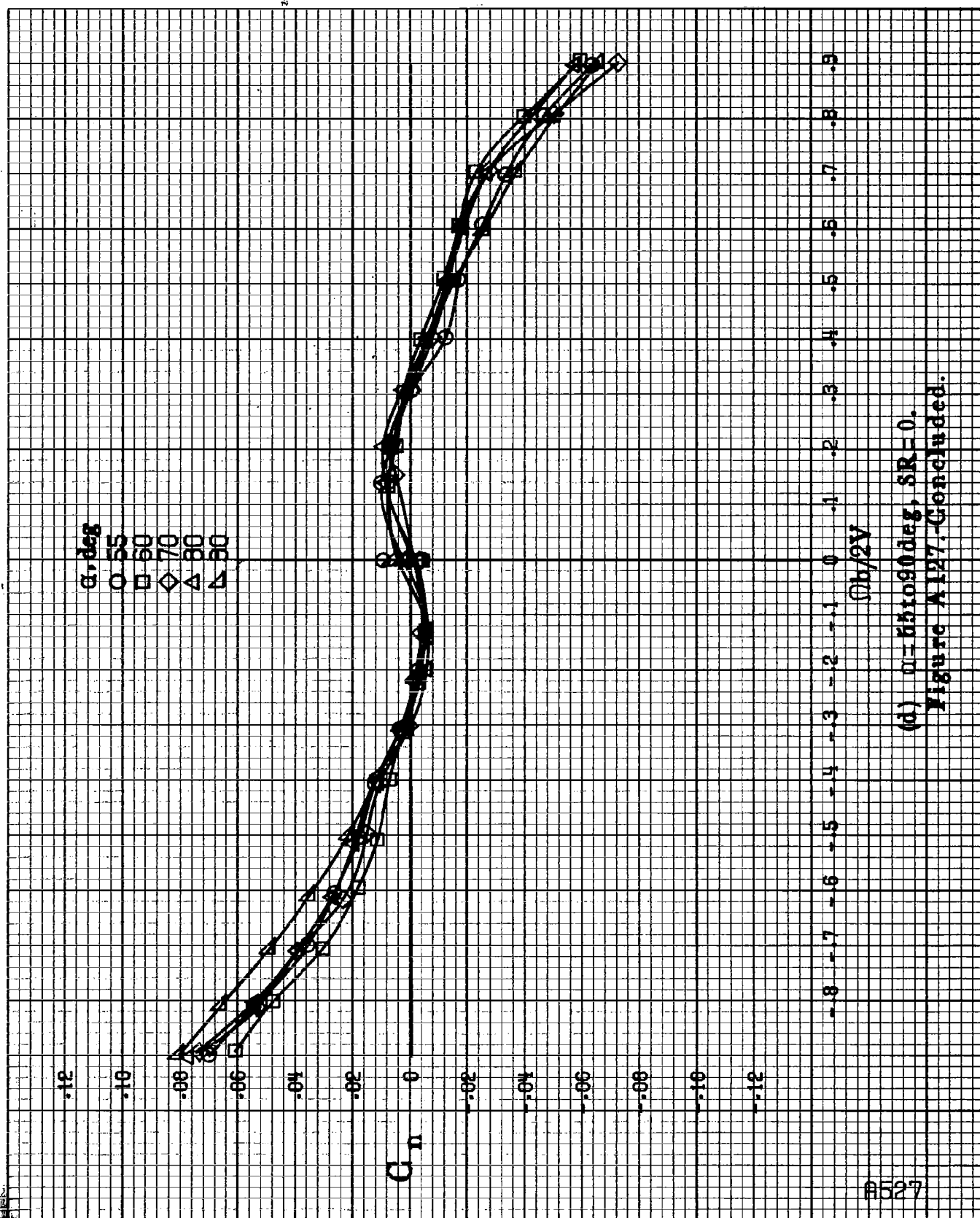


(b)  $\alpha = 18$  to  $35$  deg,  $SR = 182.9$  cm (72 in).  
Figure A127-Continued.

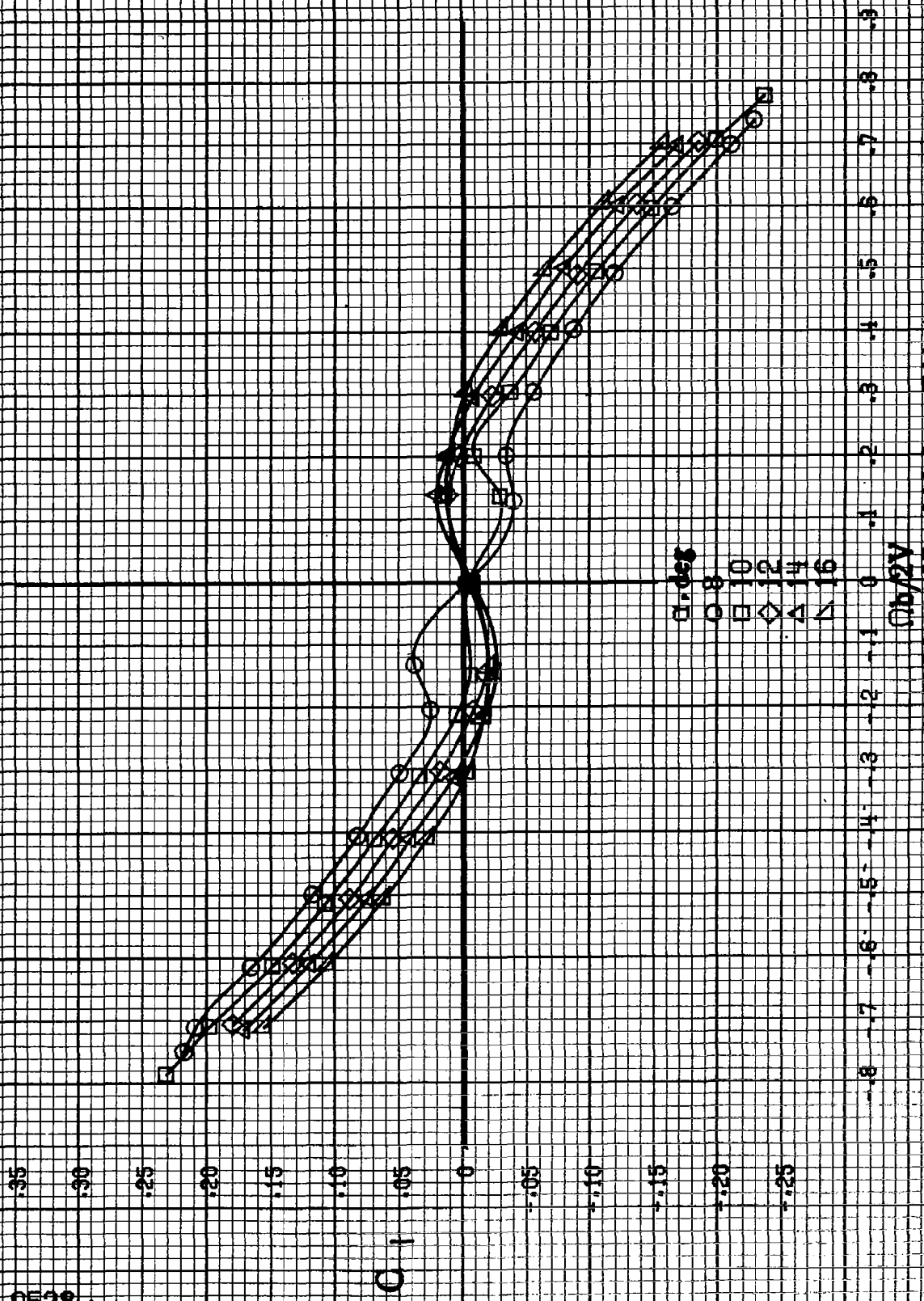
8526



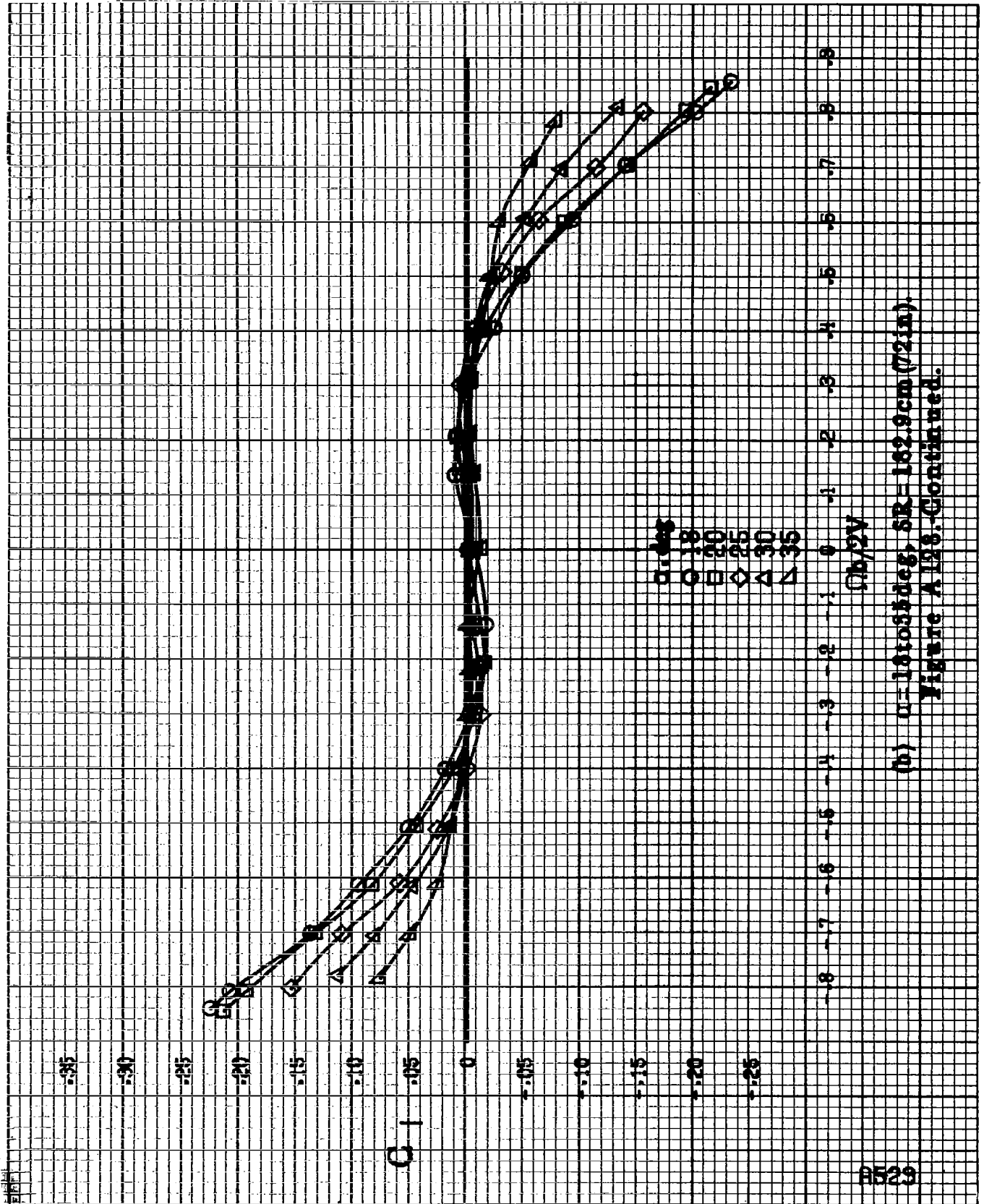
(c)  $\alpha=30$  to  $50^\circ$ ,  $SR=0$ .  
Figure A127-Continued.



(d)  $\alpha=55$  to  $90^\circ$  deg,  $SR=0$ .  
Figure A127. Concluded.

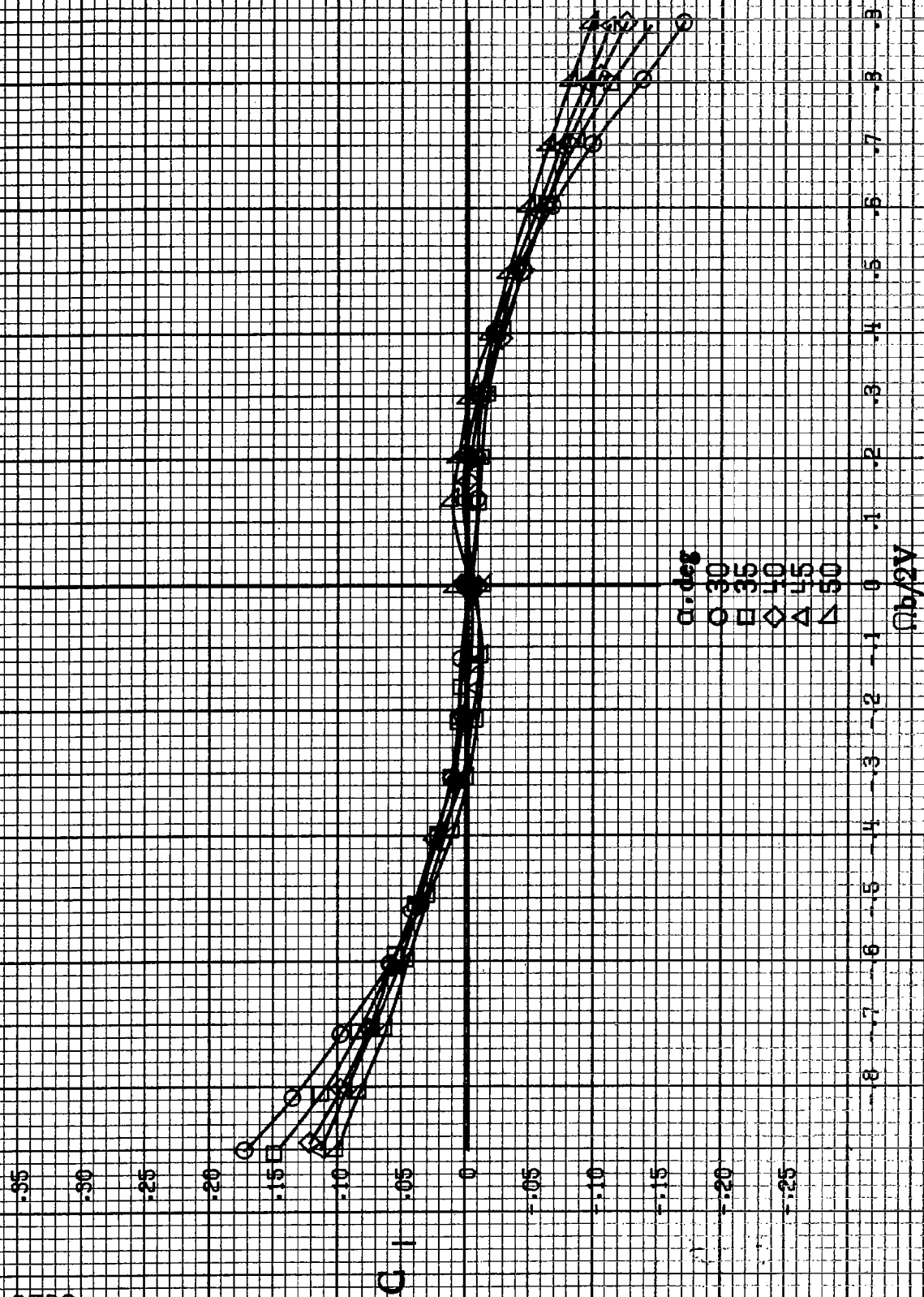


(a)  $\alpha = 8$  to  $16^\circ$ ,  $GR = 182.9 \text{ cm (72 in.)}$ .  
 Figure A128.-Effect of rotation rate and angle of attack on rolling-moment coefficient for dorsal fin off configuration.  $\delta_r = 0^\circ$ ,  $\delta_s = 0^\circ$ ,  $\delta_v = 0^\circ$ .

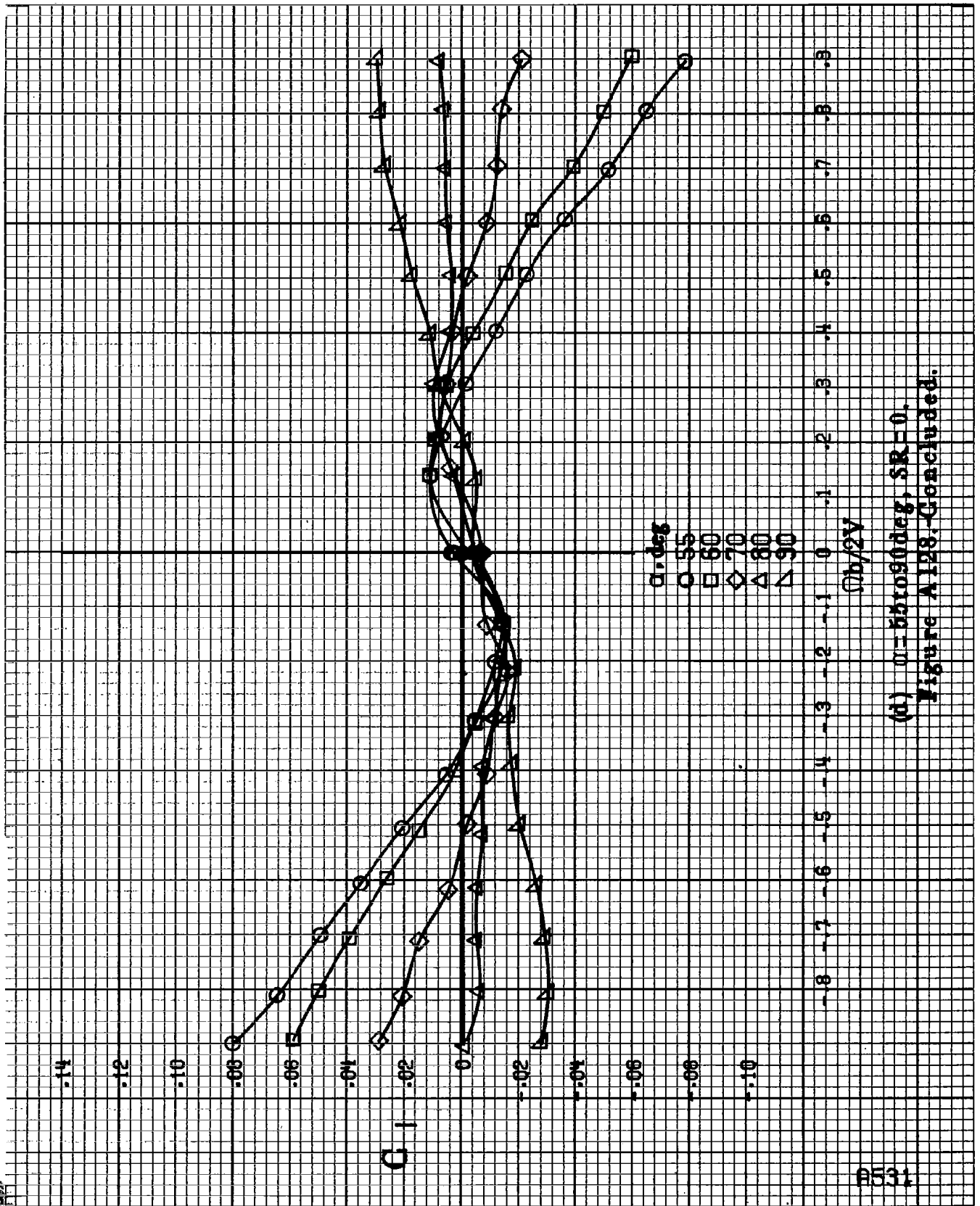


(b)  $\alpha = 18$  to  $35$  deg,  $SR = 162.9$  cm (72 in).  
Figure A128-Continued.

A530

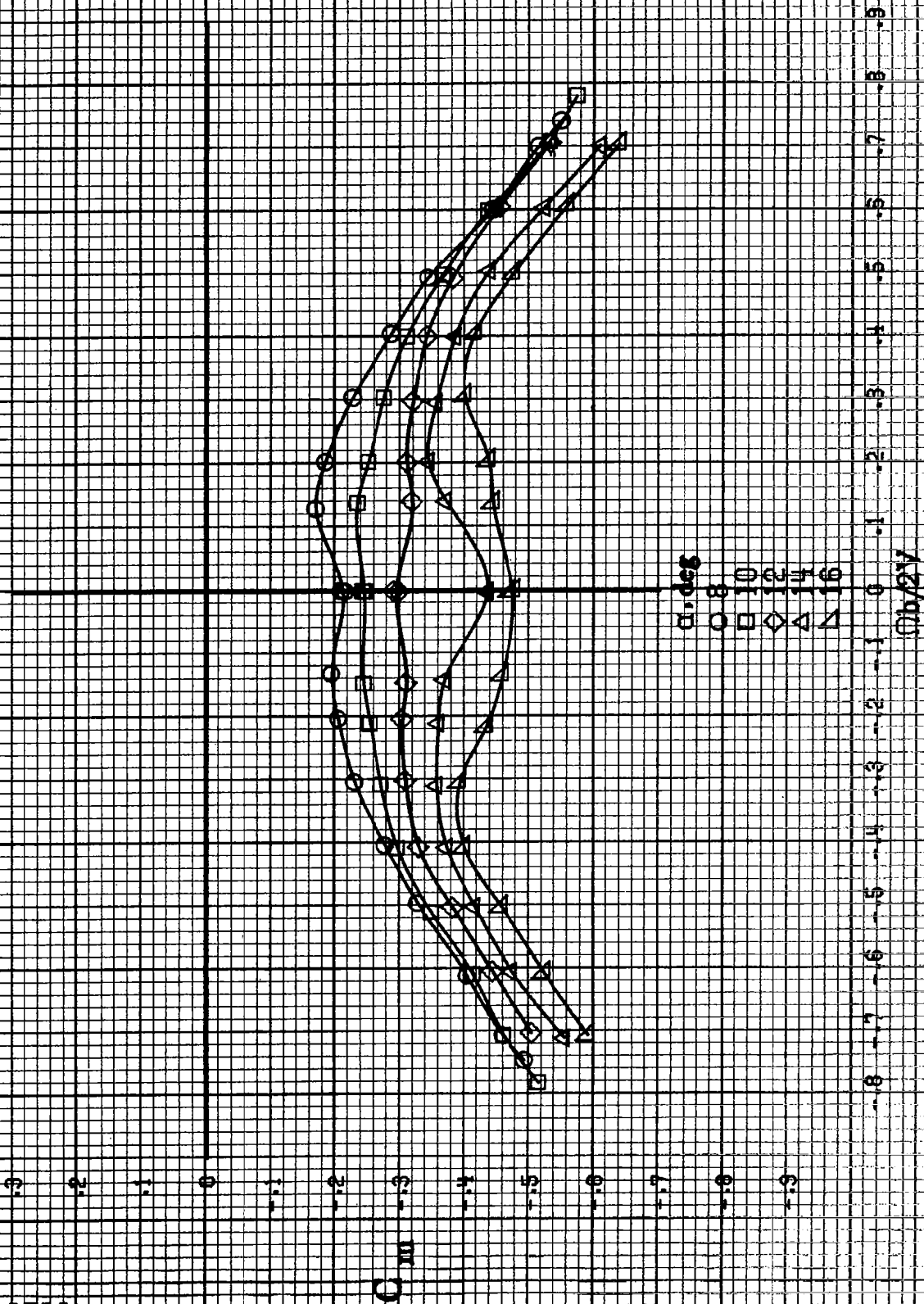


(c)  $\alpha = 30$  to  $50$  deg,  $SR = 0$ .  
Figure A128-Continued.



(d)  $\alpha=55$  to  $90^\circ$ ,  $SR=0$ .  
Figure A128. Concluded.

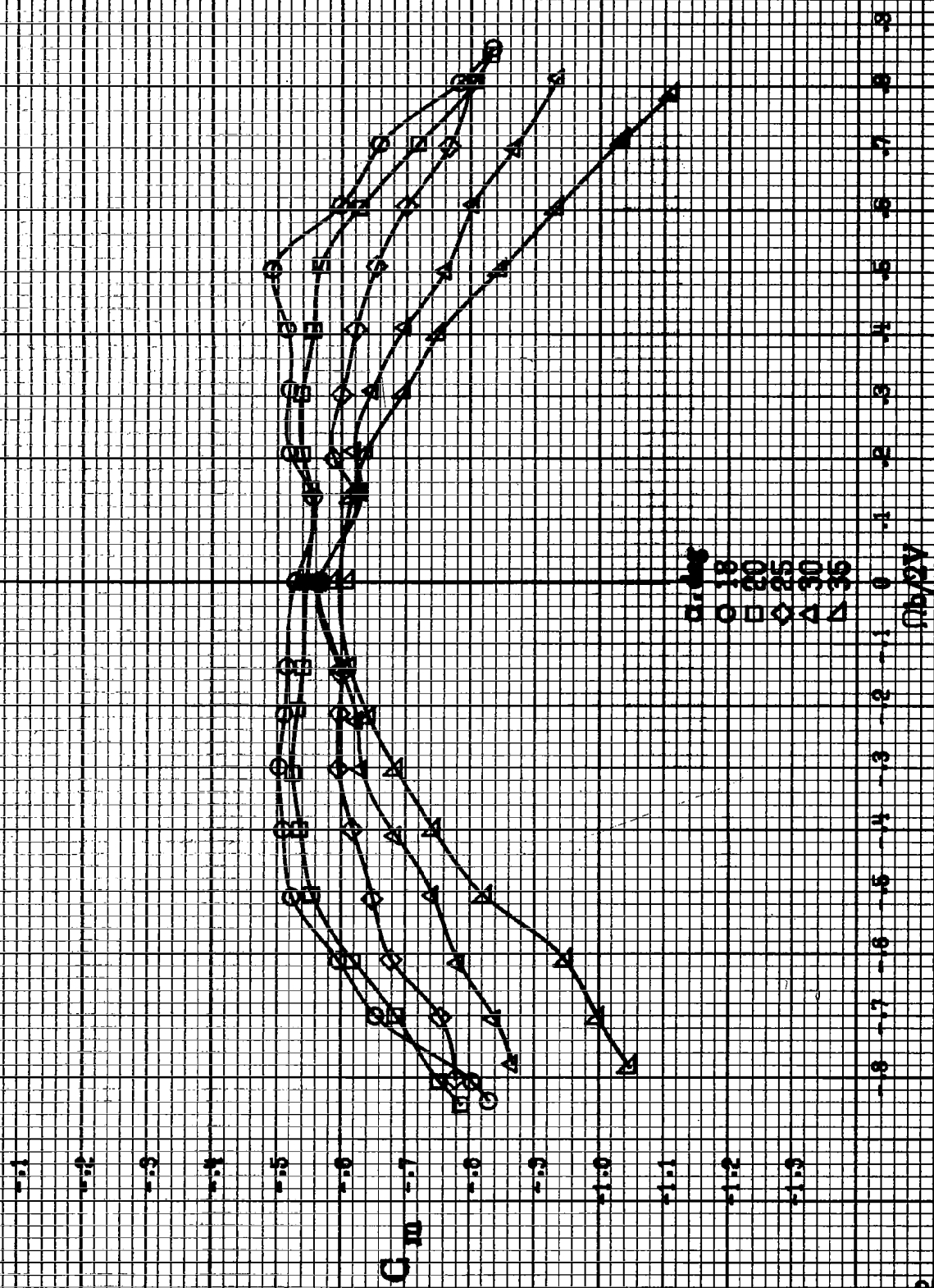
8532



(a)  $\alpha = 8$  to  $16$  deg,  $SR = 182.9$  cm (72 in).

Figure A.128.-Effect of rotation rate and angle of attack on pitching moment coefficient for dormal fin off configuration.  $\delta = 0^\circ$ ,  $\delta = 0^\circ$ ,  $\delta = 0^\circ$ .

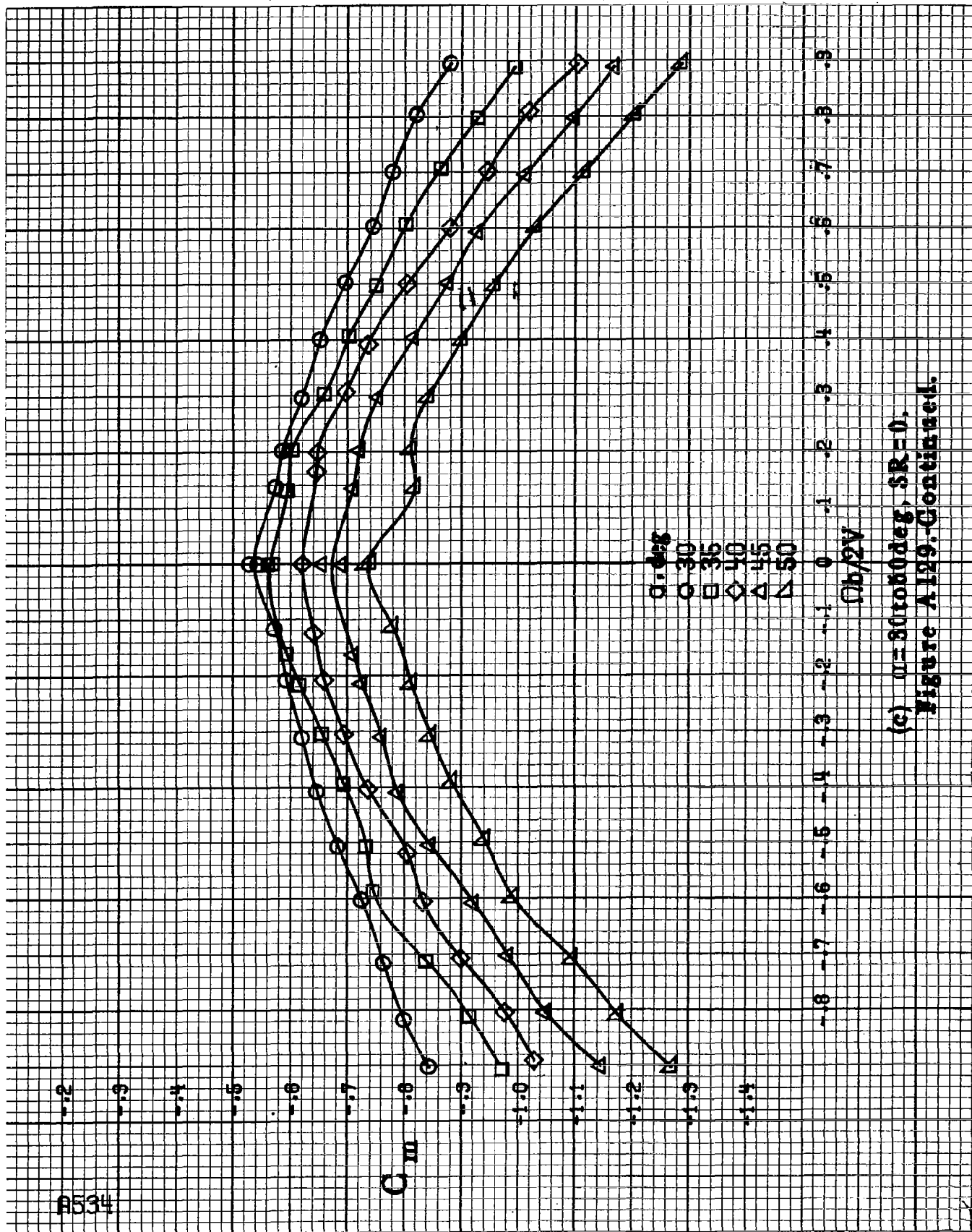




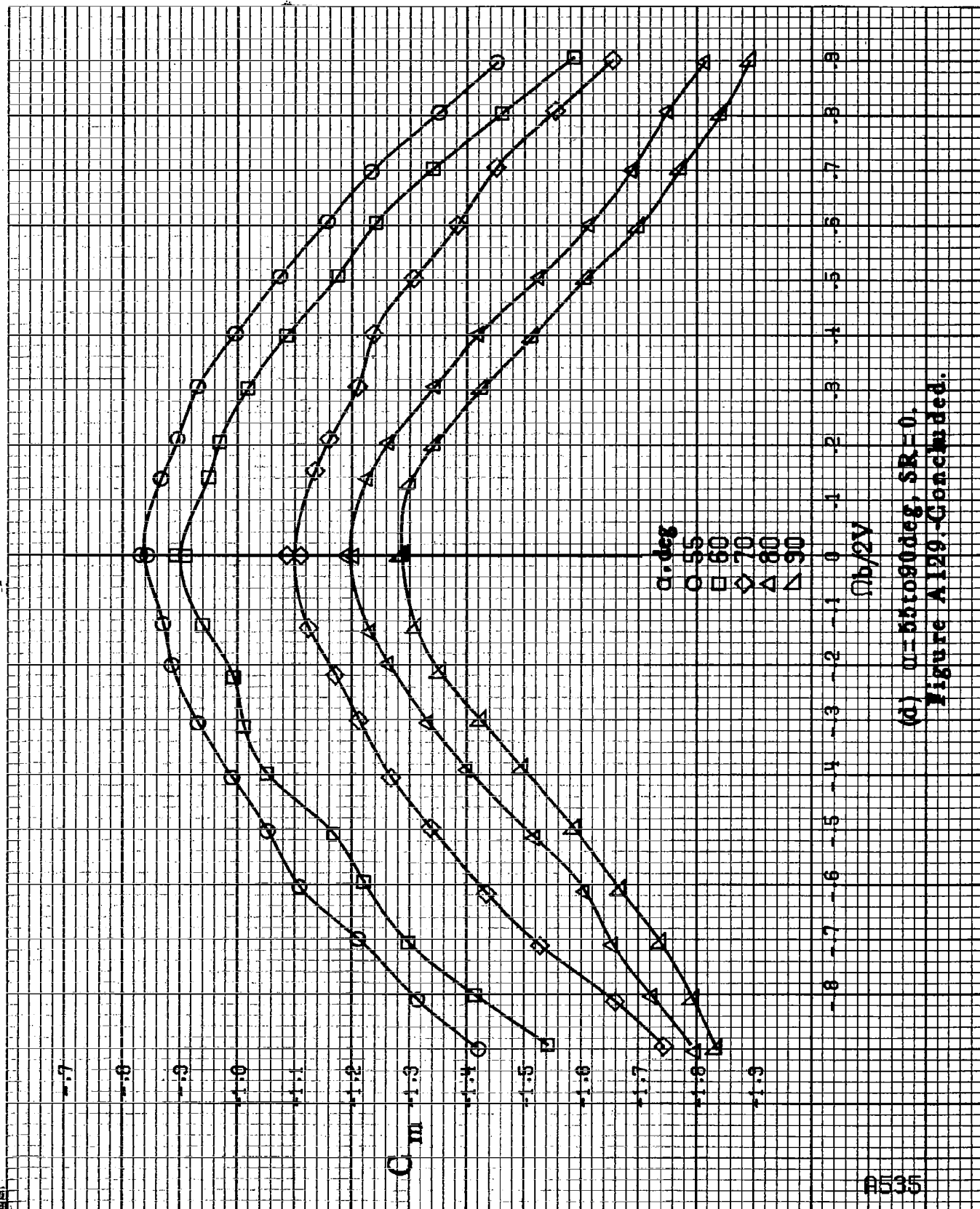
(b)  $\alpha = 18$  to  $35^\circ$ ,  $\delta R = 182.9$  cm (72 in).

Figure A129. Continued.

A534



(c)  $\alpha = 30$  to  $50^\circ$ ,  $SR = 0$ .  
Figure A129-Continued.



(d)  $\alpha = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A129. Concluded.

5536

2.2

2.0

1.8

1.6

1.4

1.2

1.0

.8

.6

.4

.2

0

-.2

$\alpha$ , deg

8

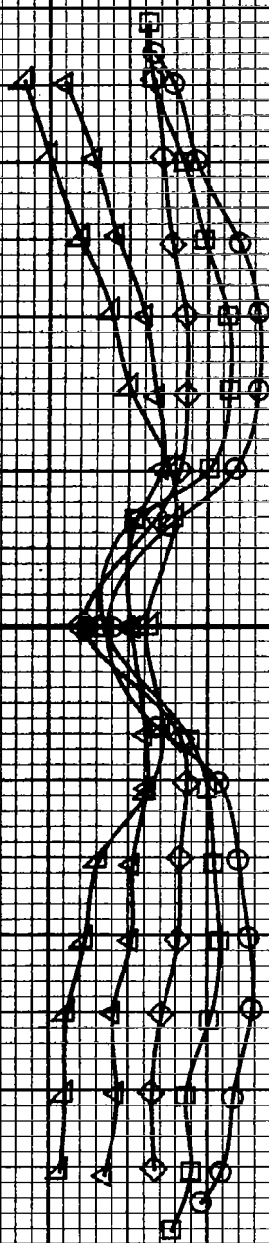
10

12

14

16

CN



Ob/2V

(a)  $\alpha = 8$  to  $16$  deg, SR = 182.9 cm (72 in).

Figure A136.—Effect of rotation rate and angle of attack on normal force coefficient for dorsal fin off configuration.  $\delta_e = 0^\circ$ ,  $\delta_a = 0^\circ$ ,  $\delta = 0^\circ$ .

$\alpha$ , deg  
 O 18  
 □ 20  
 ◇ 25  
 △ 30  
 ▲ 35

C/N

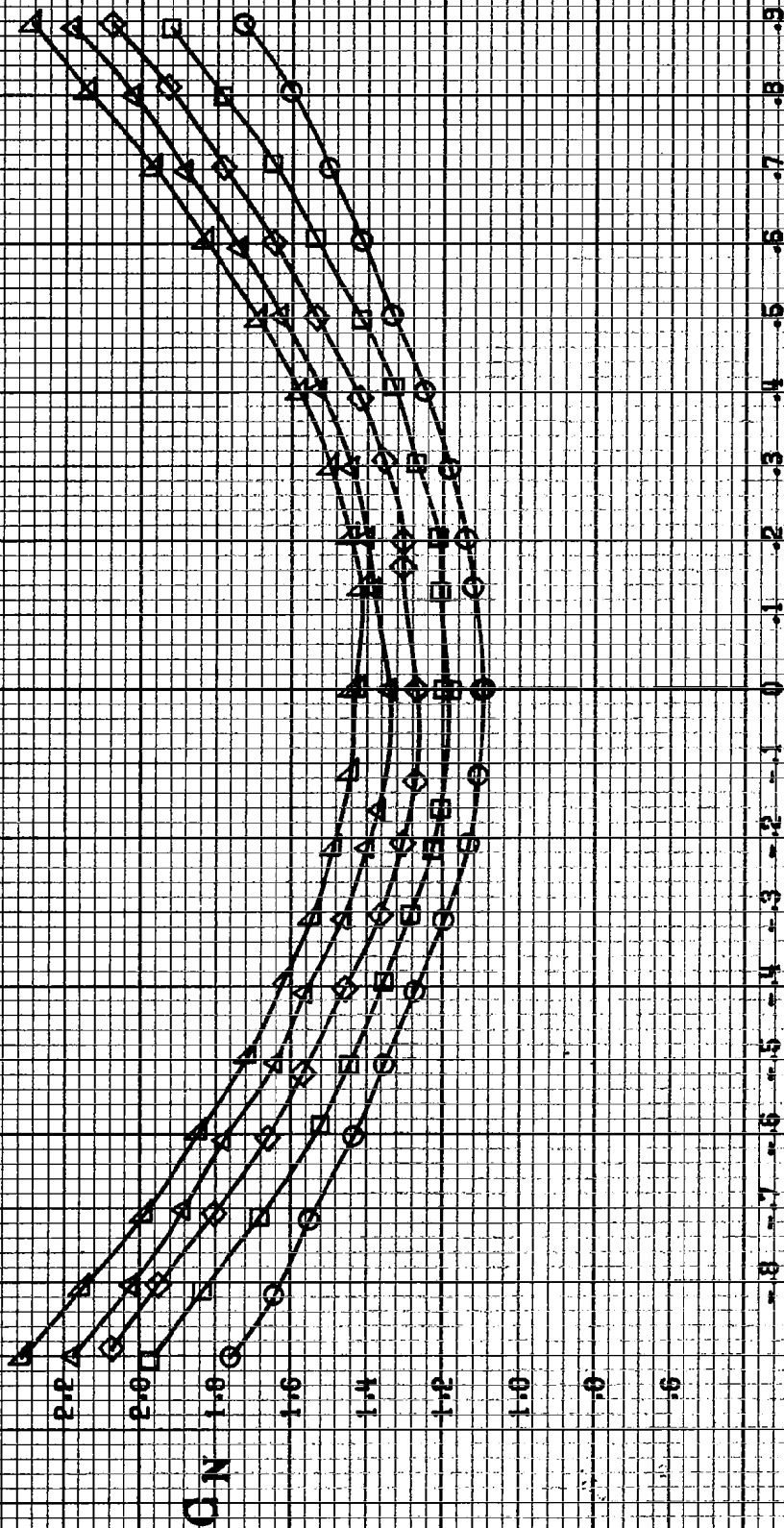
$\Omega_b/2\pi$

(b)  $\alpha = 18$  to  $35$  deg,  $SR = 182.9$  cm (72 in),  
 Figure A130. Continued.

A537

#538

$\alpha$ , deg  
 ○ 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▲ 50



Qb/2V

(c)  $\alpha=30$  to  $50$  deg,  $SR=0$ .  
 Figure A130-Continued.

$\alpha$ , deg  
 55  
 60  
 65  
 70  
 75  
 80

3.2  
 3.0  
 2.8  
 2.6  
 2.4  
 2.2  
 2.0  
 1.8  
 1.6  
 1.4  
 1.2  
 1.0  
 .8

CN

-8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8

$\phi_b/2V$

(d)  $m=55$  to  $90$  deg,  $SR=0$ .  
 Figure A130: Concluded.

8540

$\alpha, \text{deg}$   
 ○ 8  
 □ 10  
 ◇ 12  
 △ 14  
 ▽ 16

$C_Y$

$\frac{b}{2V}$

(a)  $\alpha = 8 \text{ to } 16 \text{ deg}$ ,  $SR = 182.9 \text{ cm} (72 \text{ in})$ .

Figure A181.-Effect of rotation rate and angle of attack on side-force coefficient for dorsal fin off configuration.  $C_e \pm 0^\circ$ ,  $C_e \pm 0^\circ$ ,  $C_e \pm 0^\circ$ ,  $C_e \pm 0^\circ$ .



0.8

0.7

0.6

0.5

0.4

0.3

0.2

0.1

0

-0.1

-0.2

-0.3

-0.4

Gy

0.18

0.20

0.25

0.30

0.35

$\eta_h/2V$

-0.8

-0.7

-0.6

-0.5

-0.4

-0.3

-0.2

-0.1

0

0.1

0.2

0.3

0.4

0.5

0.6

0.7

0.8

0541

(b)  $\alpha = 18$  to  $51$  deg,  $SR = 182.9$  cm (72 in).  
Figure A191-Continued.

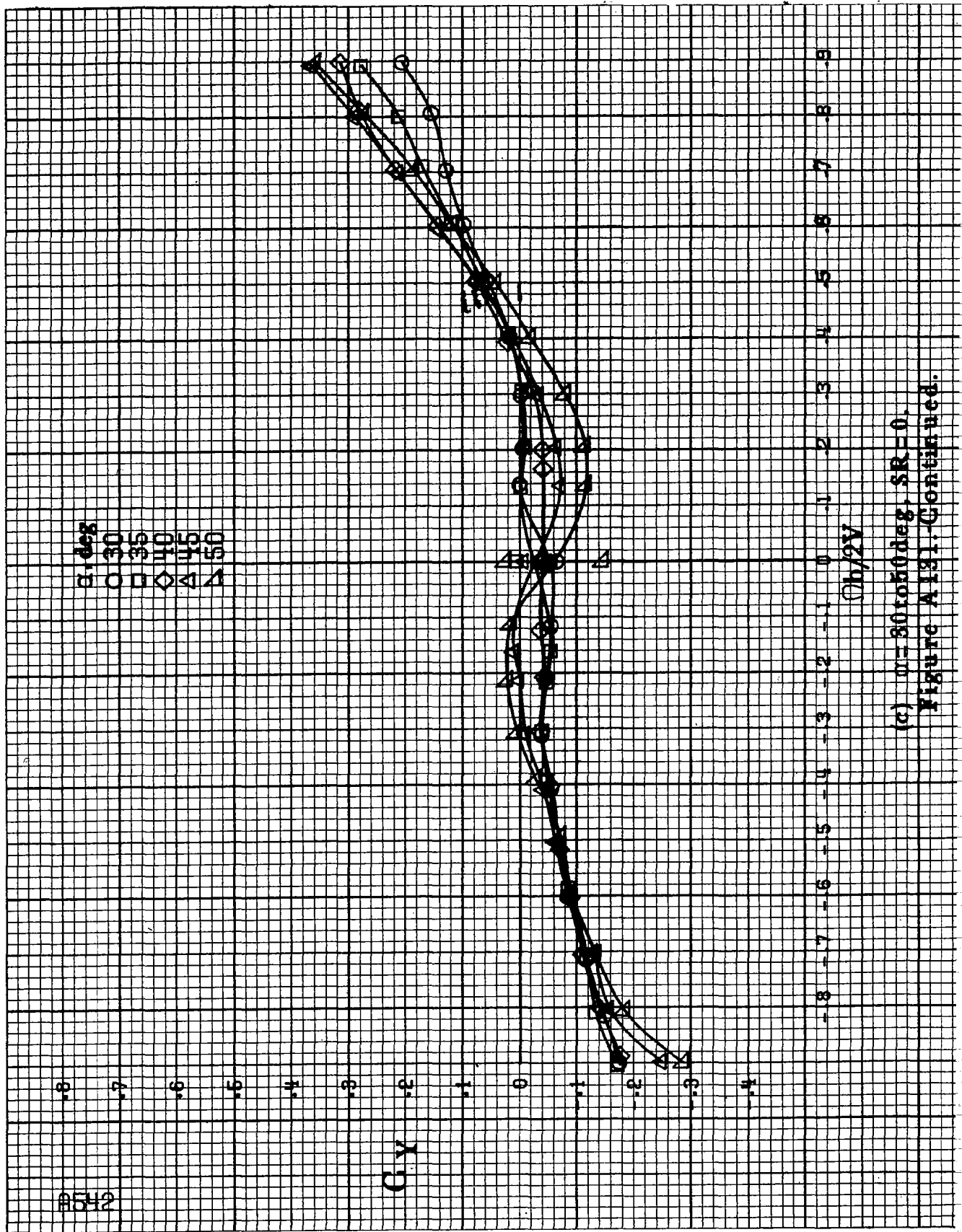
#542

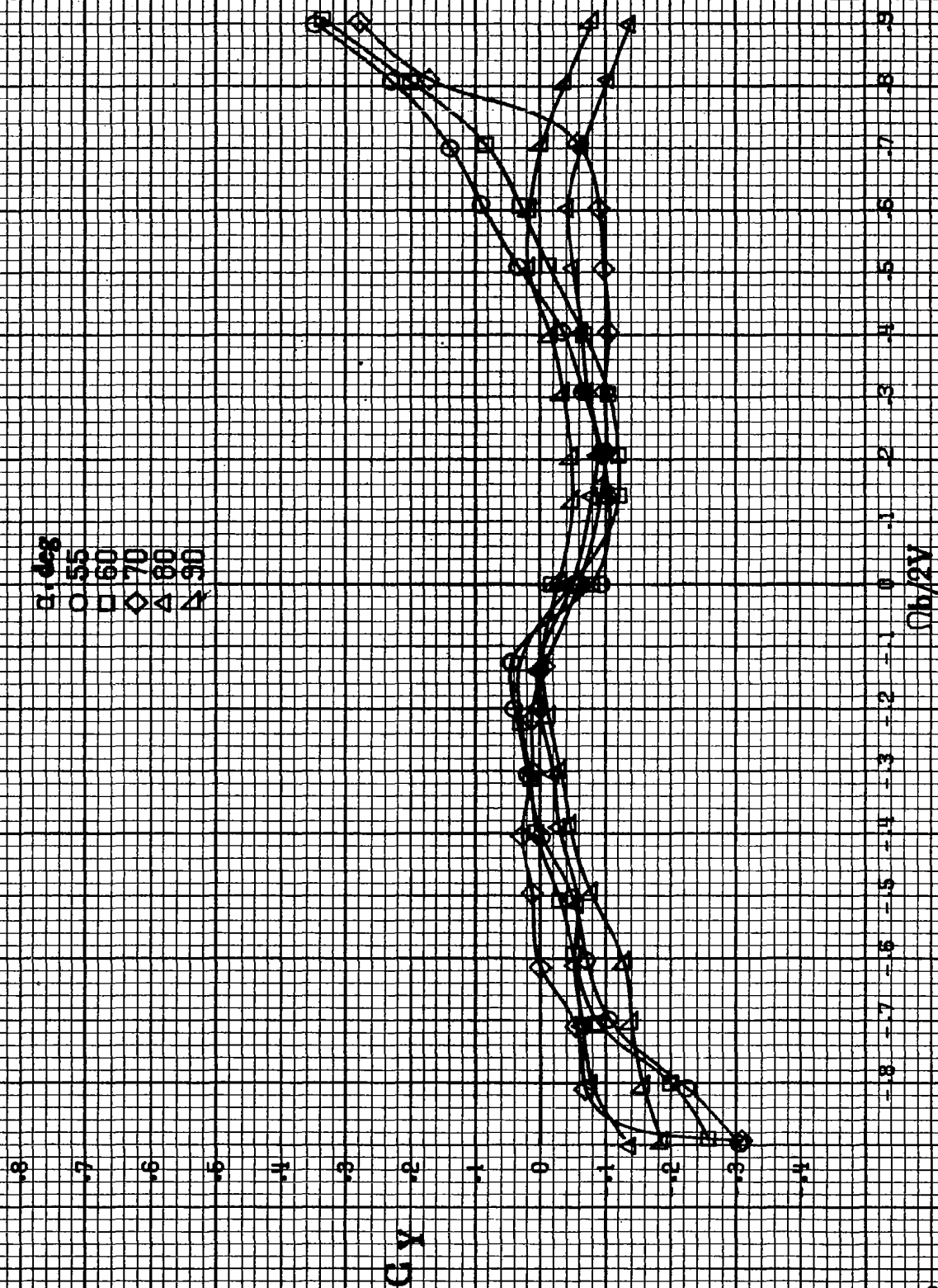
$\alpha$ , deg  
 30  
 35  
 40  
 45  
 50

$C_V$

$\Omega h/2V$

(a)  $\alpha = 30$  to  $50$  deg,  $SR = 0$ .  
 Figure A131. Continued.





(d)  $\alpha=55$  to  $90$  deg,  $SR=0$ .  
Figure A181. Continued.

544

$\alpha, \text{deg}$   
 8  
 10  
 12  
 14  
 16

$G_A$

$\phi_b/2V$

(a)  $\alpha = 8$  to  $16$  deg,  $S_M = 182.9 \text{ cm}^2/2 \text{ in}^2$ .

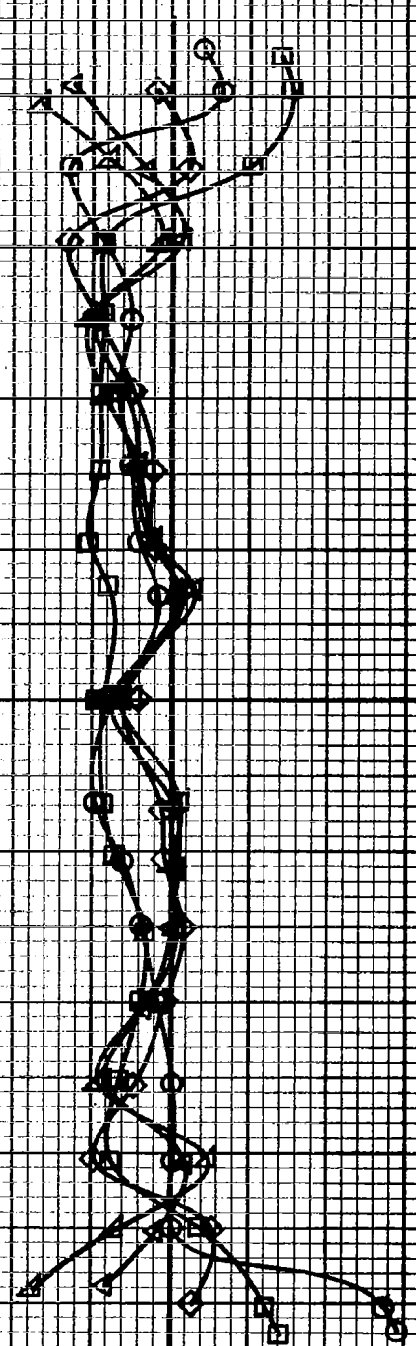
Figure A132.-Effect of rotation rate and angle of attack on axial-force coefficient for dorsal fin of configuration.  $\phi_a = 0^\circ$ ,  $\delta_a = 0^\circ$ ,  $\delta = 0^\circ$ .

8.148  
 0.18  
 0.20  
 0.25  
 0.30  
 0.35

Cl A

Ob/2V

(b)  $n = 18$  to  $35$  deg,  $SR = 182.9 \text{ cm (72 in.)}$   
 Figure A132-Continued.



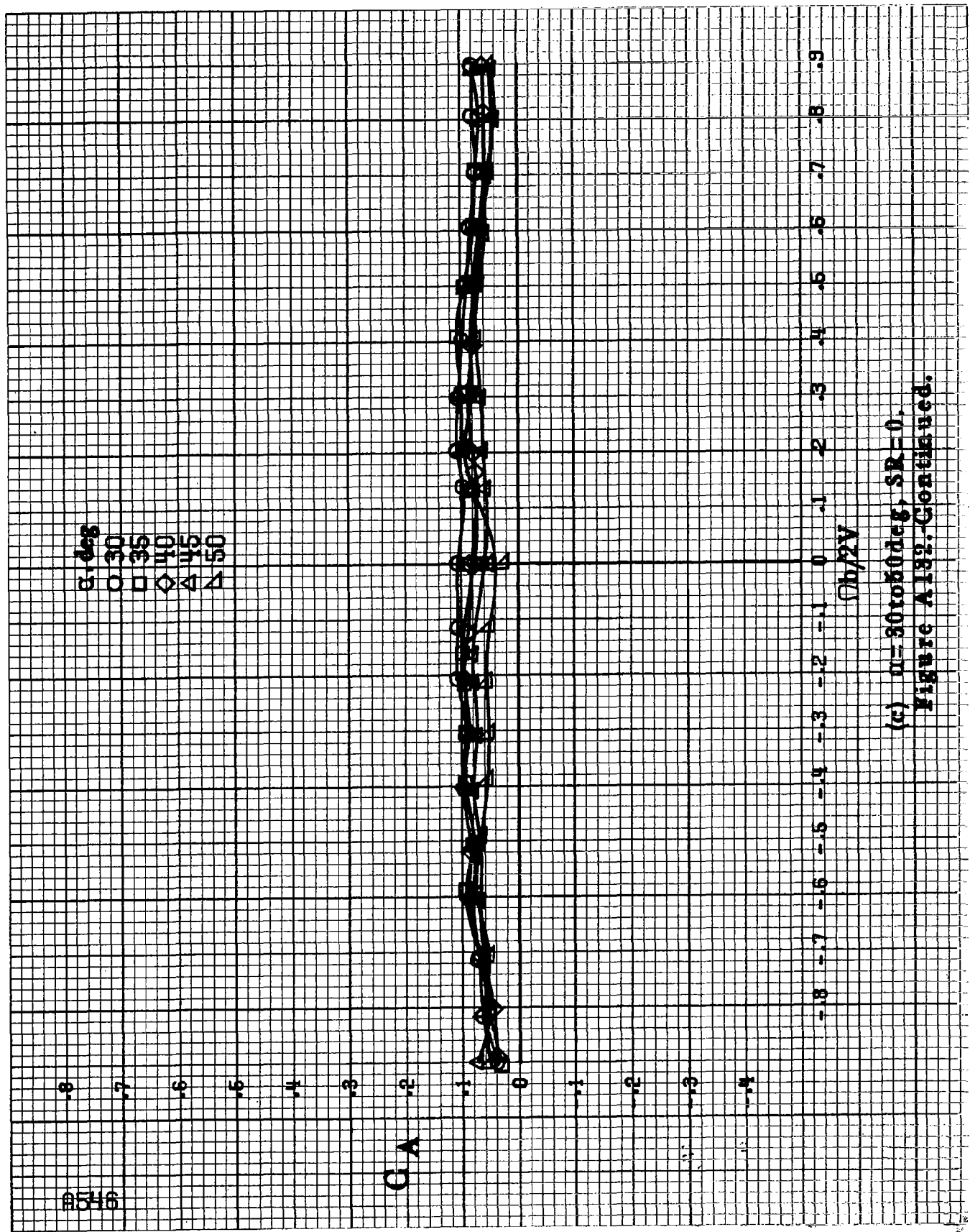
3546

$\alpha$ , deg  
 ○ 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▽ 50

GA

$\phi_b/2V$

(c)  $\mu = 30$  to  $60$  deg,  $SR = 0$ .  
 Figure A132-Continued.



$\alpha$ , deg  
 ○ 55  
 □ 60  
 ◇ 70  
 △ 80  
 ▲ 90

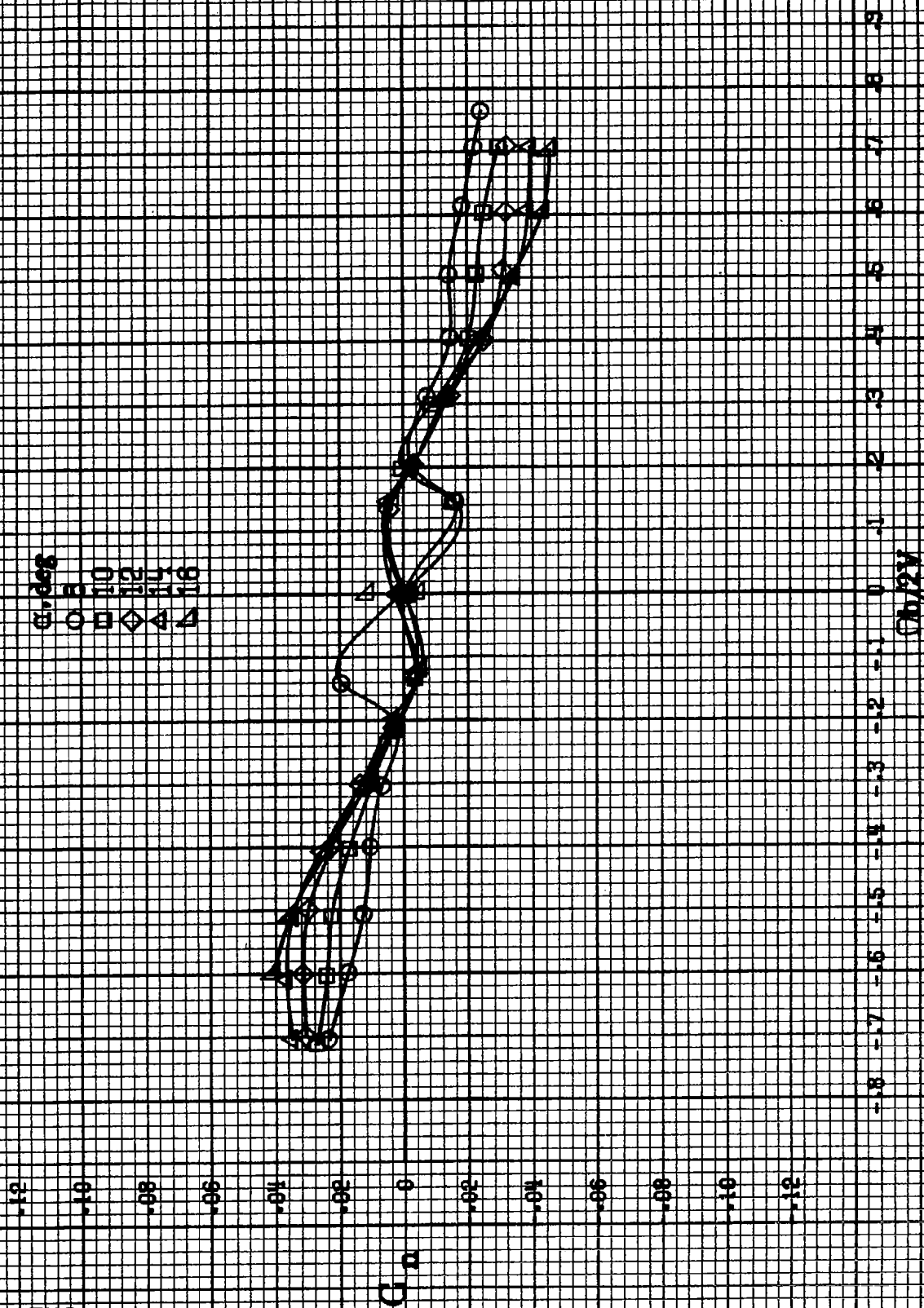
CL A

$\Omega b/2V$

(d)  $n=55$  to  $90$  deg,  $SR=0$ .  
 Figure A182-Continued.

8547

#548

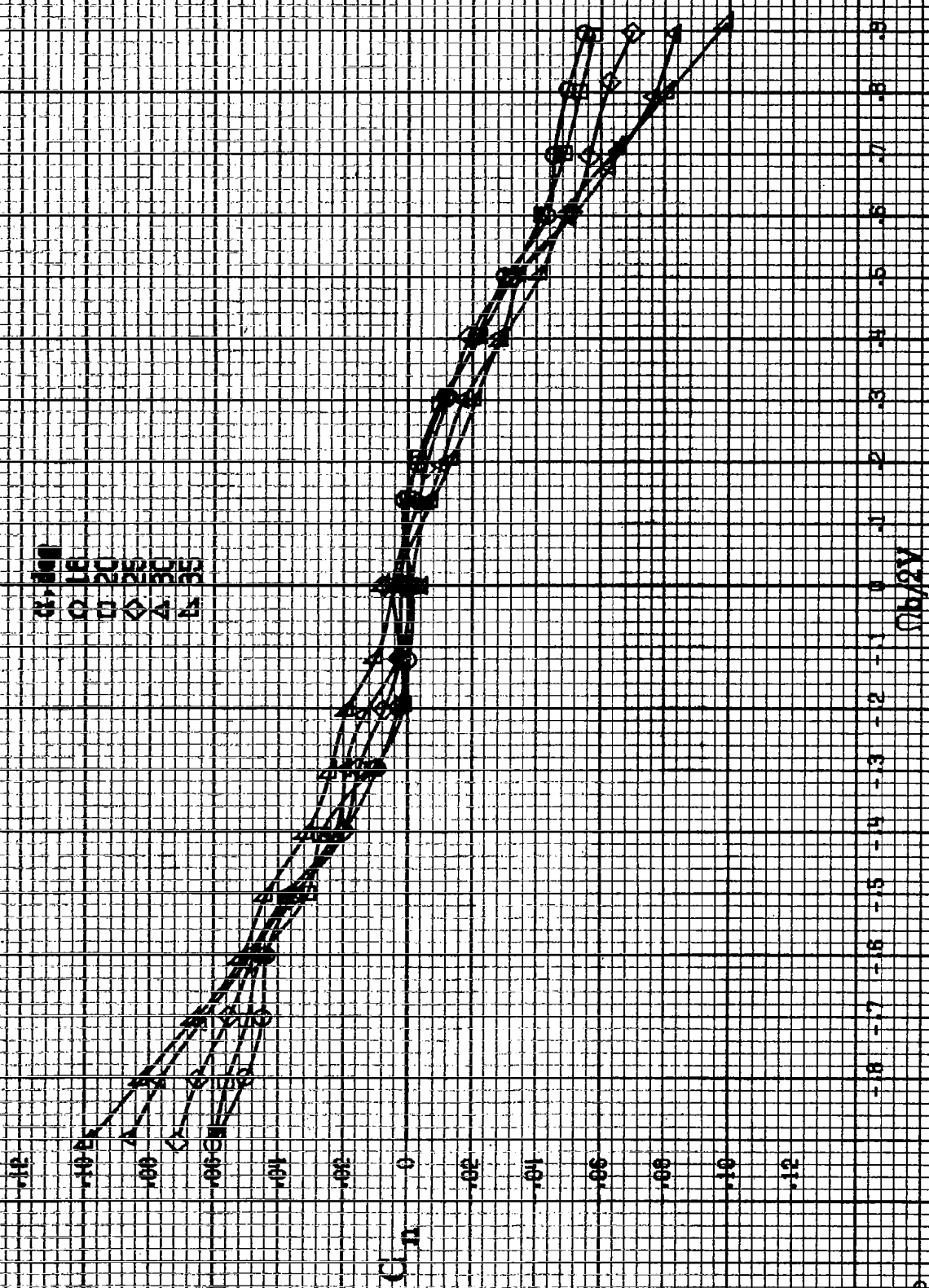


(a)  $\alpha = 8$  to  $16$  deg,  $S_R = 132$  sem (72 in).

Figure A182.-Effect of rotation rate and angle of attack on yawing moment coefficient for T-tail configuration.  $\delta_a = 0^\circ$ ,  $\delta_r = 0^\circ$ ,  $\beta = 0^\circ$ .



10-33



(b)  $\alpha=16$  to  $35$  deg,  $SR=182.9$  cm (72 in).  
Figure A188. Continued.

8550

.12

.10

.08

.06

.04

.02

0

.02

.04

.06

.08

.10

.12

$C_n$

6.35  
6.33  
6.31  
6.29  
6.27  
6.25  
6.23  
6.21  
6.19  
6.17  
6.15  
6.13  
6.11  
6.09  
6.07  
6.05  
6.03  
6.01  
5.99  
5.97  
5.95  
5.93  
5.91  
5.89  
5.87  
5.85  
5.83  
5.81  
5.79  
5.77  
5.75  
5.73  
5.71  
5.69  
5.67  
5.65  
5.63  
5.61  
5.59  
5.57  
5.55  
5.53  
5.51  
5.49  
5.47  
5.45  
5.43  
5.41  
5.39  
5.37  
5.35  
5.33  
5.31  
5.29  
5.27  
5.25  
5.23  
5.21  
5.19  
5.17  
5.15  
5.13  
5.11  
5.09  
5.07  
5.05  
5.03  
5.01  
4.99  
4.97  
4.95  
4.93  
4.91  
4.89  
4.87  
4.85  
4.83  
4.81  
4.79  
4.77  
4.75  
4.73  
4.71  
4.69  
4.67  
4.65  
4.63  
4.61  
4.59  
4.57  
4.55  
4.53  
4.51  
4.49  
4.47  
4.45  
4.43  
4.41  
4.39  
4.37  
4.35  
4.33  
4.31  
4.29  
4.27  
4.25  
4.23  
4.21  
4.19  
4.17  
4.15  
4.13  
4.11  
4.09  
4.07  
4.05  
4.03  
4.01  
3.99  
3.97  
3.95  
3.93  
3.91  
3.89  
3.87  
3.85  
3.83  
3.81  
3.79  
3.77  
3.75  
3.73  
3.71  
3.69  
3.67  
3.65  
3.63  
3.61  
3.59  
3.57  
3.55  
3.53  
3.51  
3.49  
3.47  
3.45  
3.43  
3.41  
3.39  
3.37  
3.35  
3.33  
3.31  
3.29  
3.27  
3.25  
3.23  
3.21  
3.19  
3.17  
3.15  
3.13  
3.11  
3.09  
3.07  
3.05  
3.03  
3.01  
2.99  
2.97  
2.95  
2.93  
2.91  
2.89  
2.87  
2.85  
2.83  
2.81  
2.79  
2.77  
2.75  
2.73  
2.71  
2.69  
2.67  
2.65  
2.63  
2.61  
2.59  
2.57  
2.55  
2.53  
2.51  
2.49  
2.47  
2.45  
2.43  
2.41  
2.39  
2.37  
2.35  
2.33  
2.31  
2.29  
2.27  
2.25  
2.23  
2.21  
2.19  
2.17  
2.15  
2.13  
2.11  
2.09  
2.07  
2.05  
2.03  
2.01  
1.99  
1.97  
1.95  
1.93  
1.91  
1.89  
1.87  
1.85  
1.83  
1.81  
1.79  
1.77  
1.75  
1.73  
1.71  
1.69  
1.67  
1.65  
1.63  
1.61  
1.59  
1.57  
1.55  
1.53  
1.51  
1.49  
1.47  
1.45  
1.43  
1.41  
1.39  
1.37  
1.35  
1.33  
1.31  
1.29  
1.27  
1.25  
1.23  
1.21  
1.19  
1.17  
1.15  
1.13  
1.11  
1.09  
1.07  
1.05  
1.03  
1.01  
0.99  
0.97  
0.95  
0.93  
0.91  
0.89  
0.87  
0.85  
0.83  
0.81  
0.79  
0.77  
0.75  
0.73  
0.71  
0.69  
0.67  
0.65  
0.63  
0.61  
0.59  
0.57  
0.55  
0.53  
0.51  
0.49  
0.47  
0.45  
0.43  
0.41  
0.39  
0.37  
0.35  
0.33  
0.31  
0.29  
0.27  
0.25  
0.23  
0.21  
0.19  
0.17  
0.15  
0.13  
0.11  
0.09  
0.07  
0.05  
0.03  
0.01  
0.00

$\Omega_0/2V$

-8 -7 -6 -5 -4 -3 -2 -1 0 .1 .2 .3 .4 .5 .6 .7 .8 .9

(c)  $\Omega = 30$  to  $50$  deg,  $SR = 0$ .  
Figure A.188-Continued.

$\alpha, \text{deg}$   
 O 55  
 □ 60  
 ◇ 70  
 △ 80  
 ▽ 90

$C_{Dn}$

$C_{Dn}/2V$

(d)  $\alpha = 55$  to  $90$  deg,  $SR = 0$ .  
 Figure A183-Continued.

8551

#552

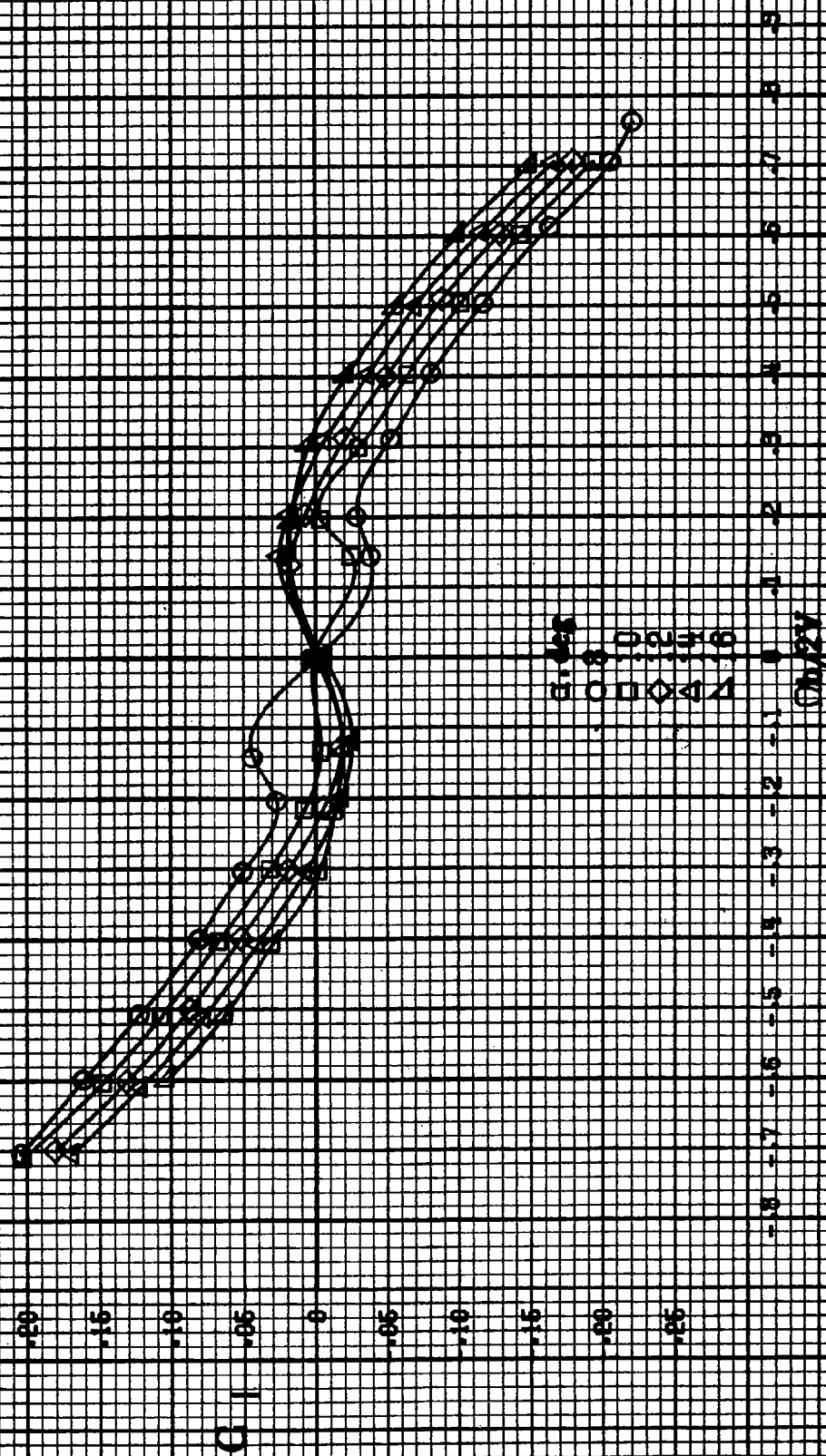
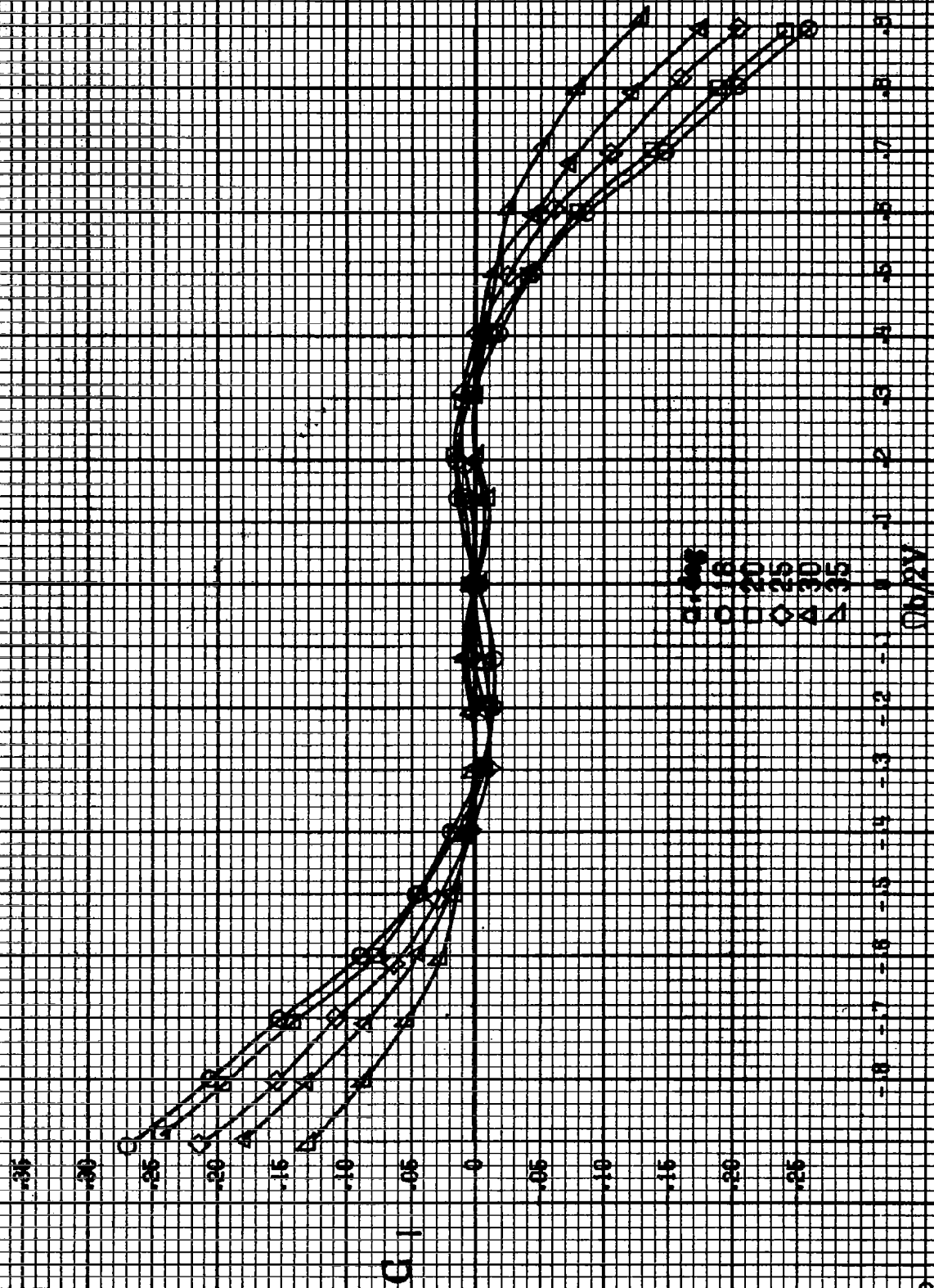
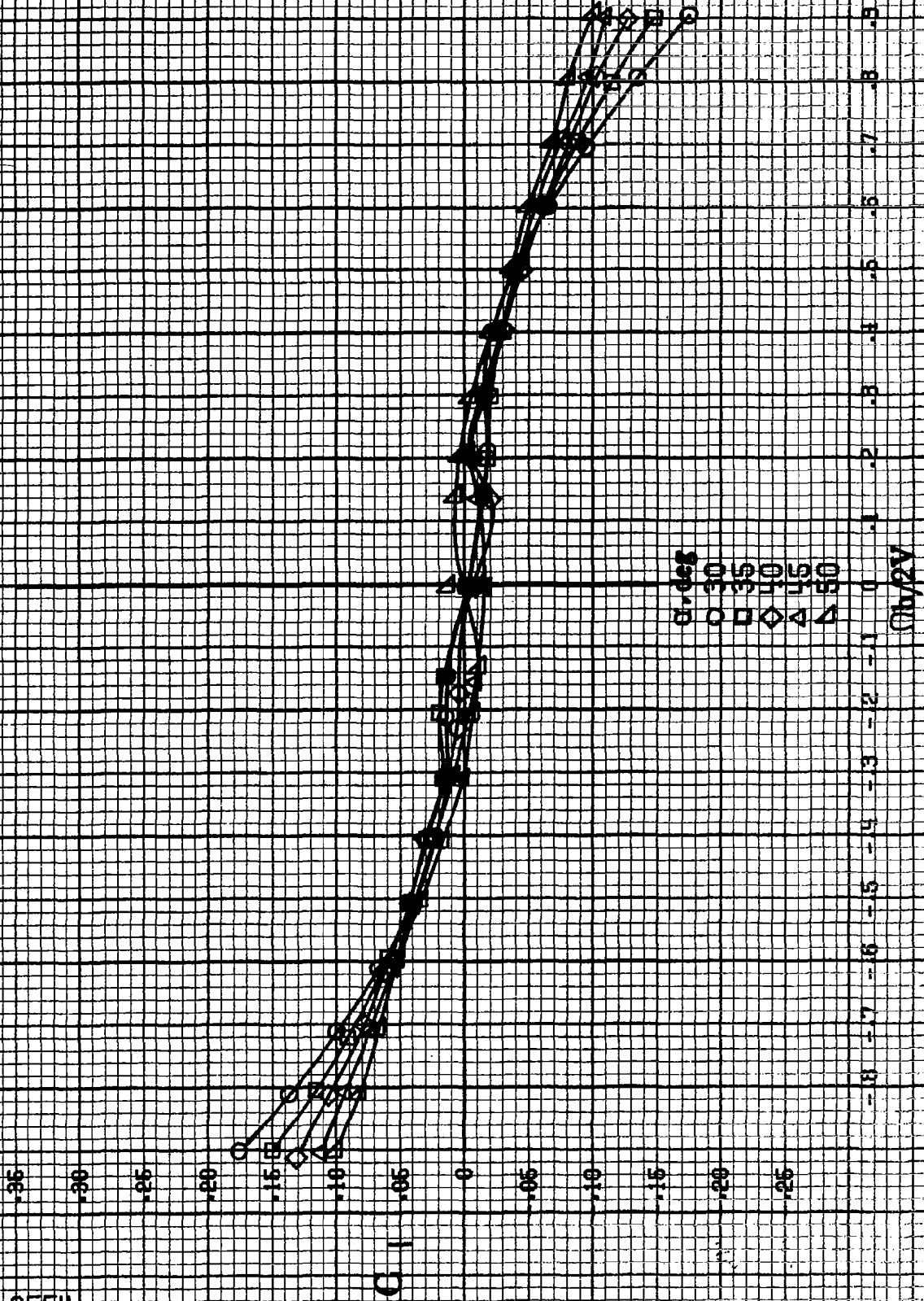


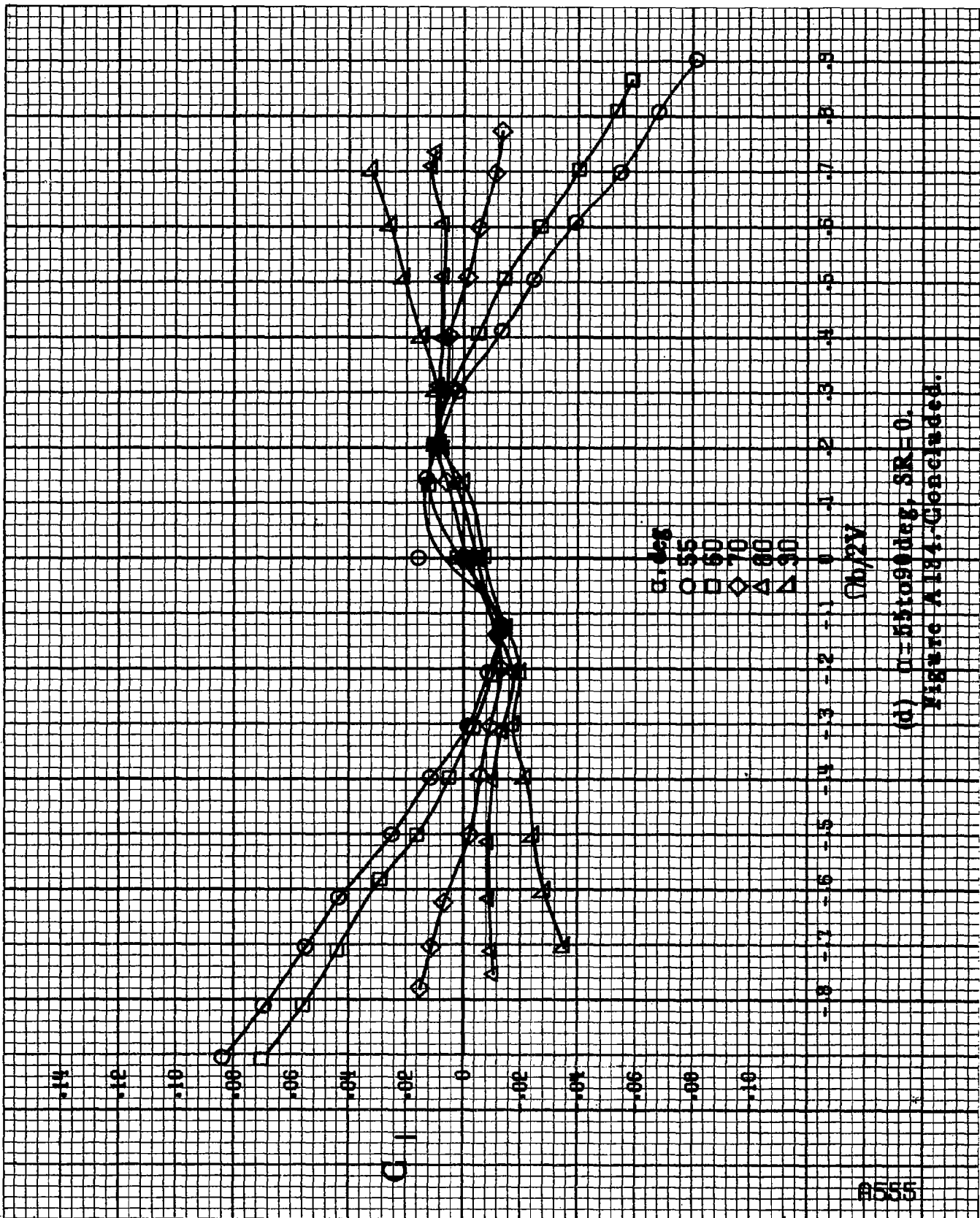
Figure A184.-Effect of rotation rate and angle of attack on rolling moment coefficient for T-tail configuration.  $\delta = 0.5^\circ$ ,  $\delta = 0.5^\circ$ ,  $\delta = 0.5^\circ$ .



(b)  $\mu = 1.6 \times 10^{23} \text{ deg}$ ,  $SR = 182.9 \text{ cm} (72 \text{ in})$ .  
Figure A 184-Cesarelli 968.



(c)  $\alpha = 30$  to  $55$  deg,  $SR = 0$ .  
Figure A184-Continued.



(d)  $\alpha = 55$  to  $90$  deg,  $SR = 0$ .  
Figure A 184. Continued.

A556

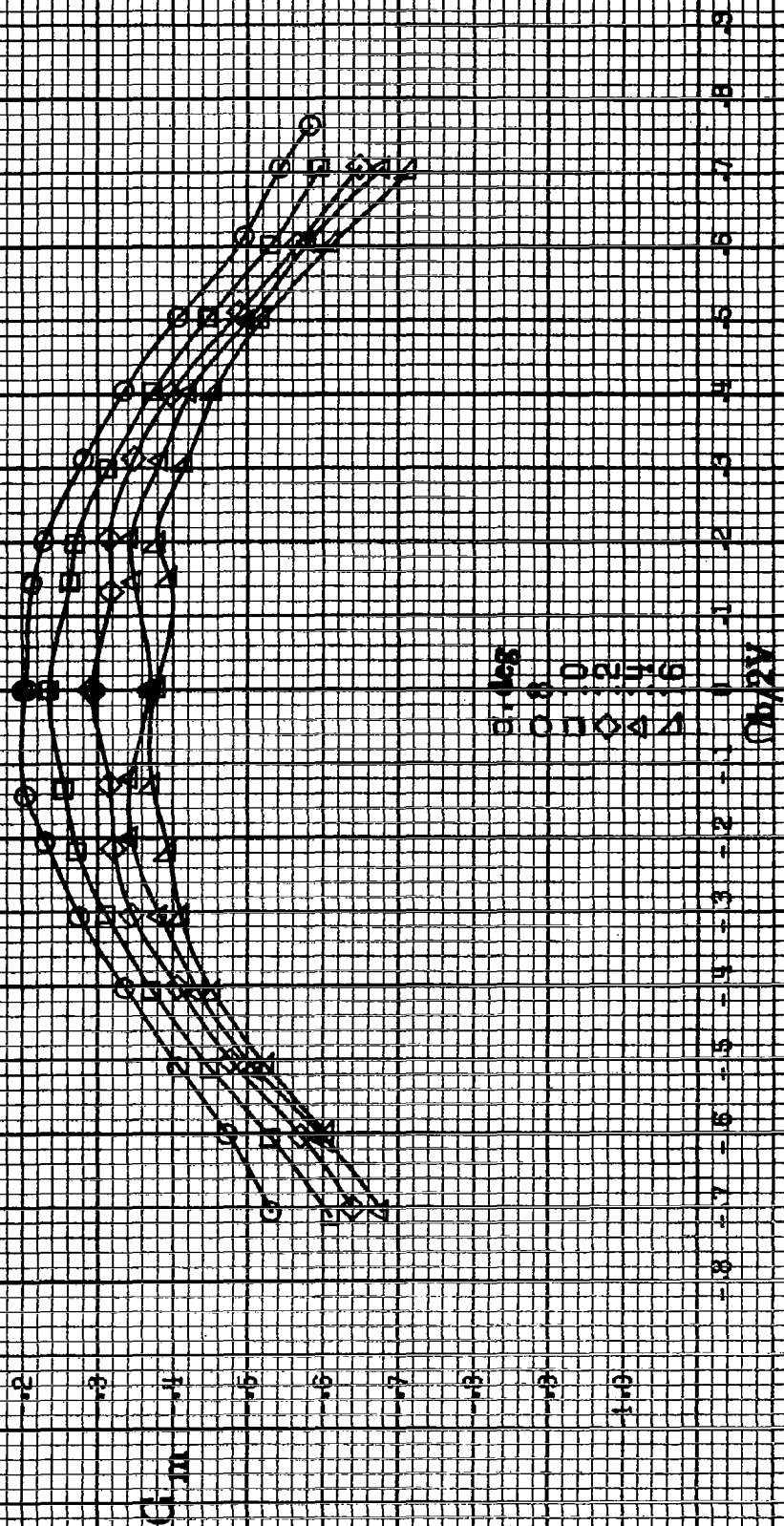
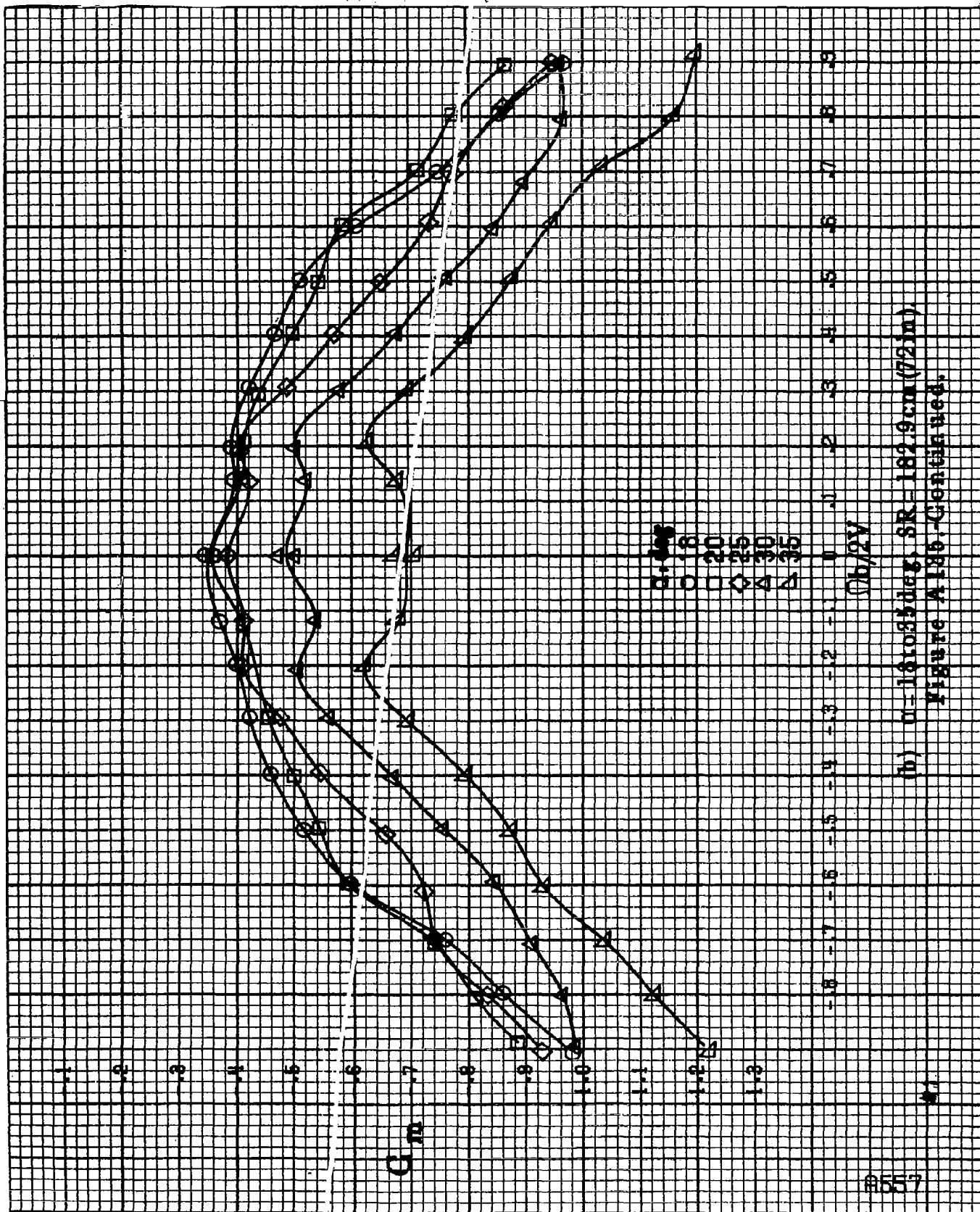


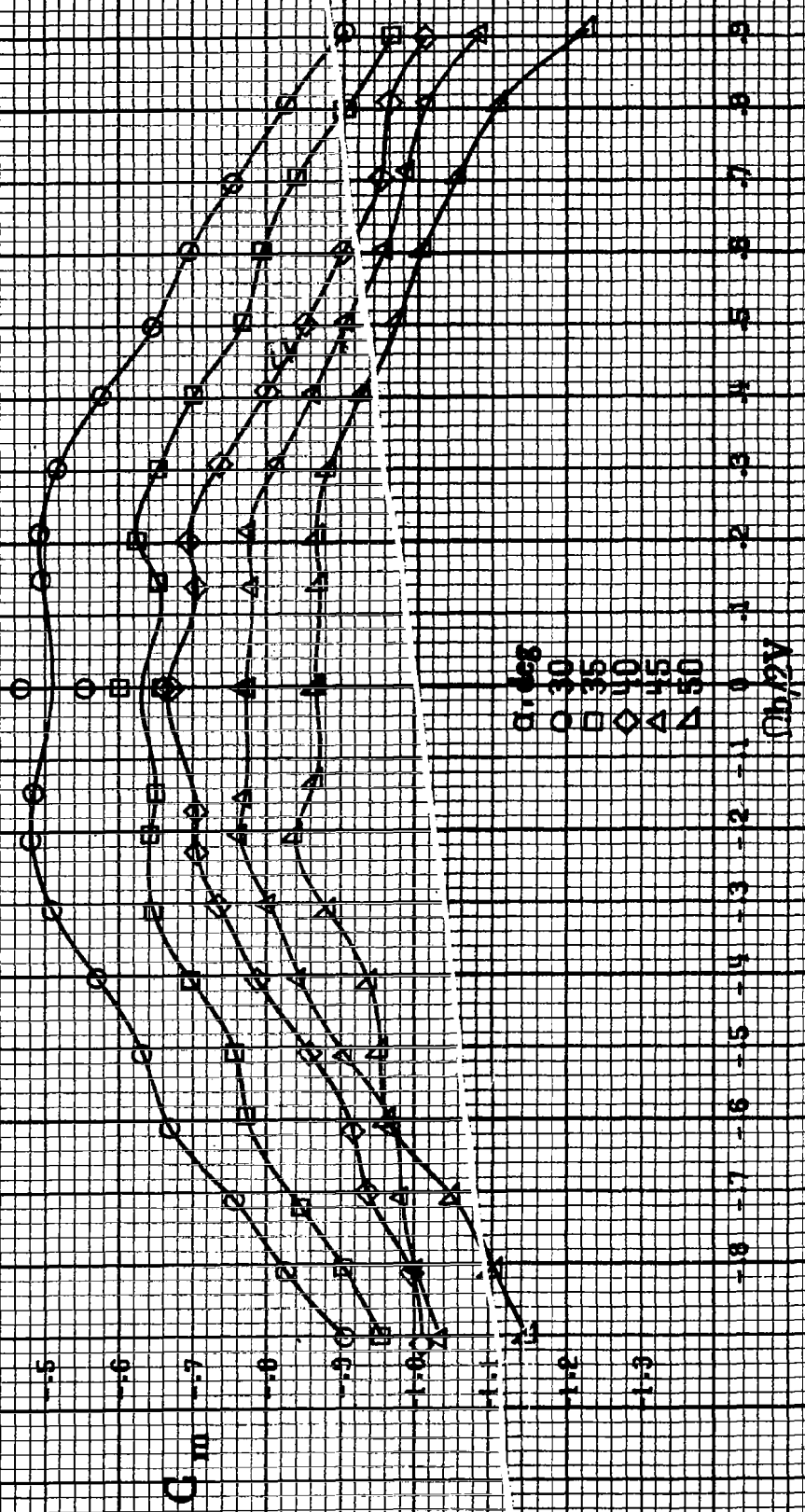
Figure A125-Effect of rotation rate and angle of attack on pitching-moment coefficient for T-tail configuration.  $\delta\alpha = 0^\circ$ ,  $\delta\lambda = 0^\circ$ ,  $\delta\gamma = 0^\circ$ ,  $\delta\beta = 0^\circ$ . (a)  $\alpha = 81.6 \text{ deg}$ ,  $SR = 132.8 \text{ cm} (72 \text{ in})$ .



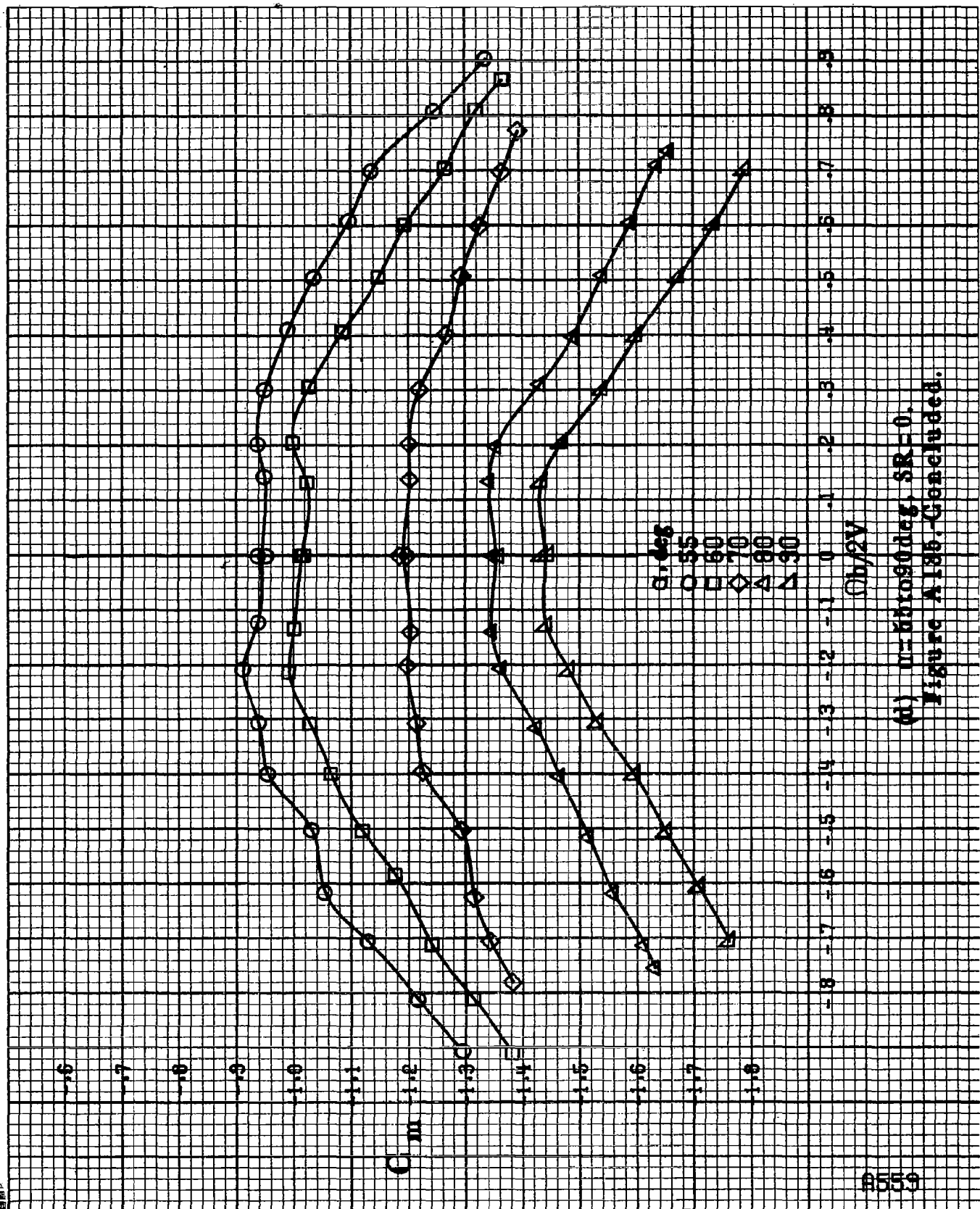


(b)  $\alpha=18$  to 35 deg,  $SR=182.9$  cm (72 in).  
Figure A185. Continued.

A558



(c)  $m=80$  to  $800$  deg,  $SR=0$ .  
Figure A136. Continued.



(d)  $n=60^\circ$  deg,  $SR=0$ .  
Figure A185. Concluded.

8560

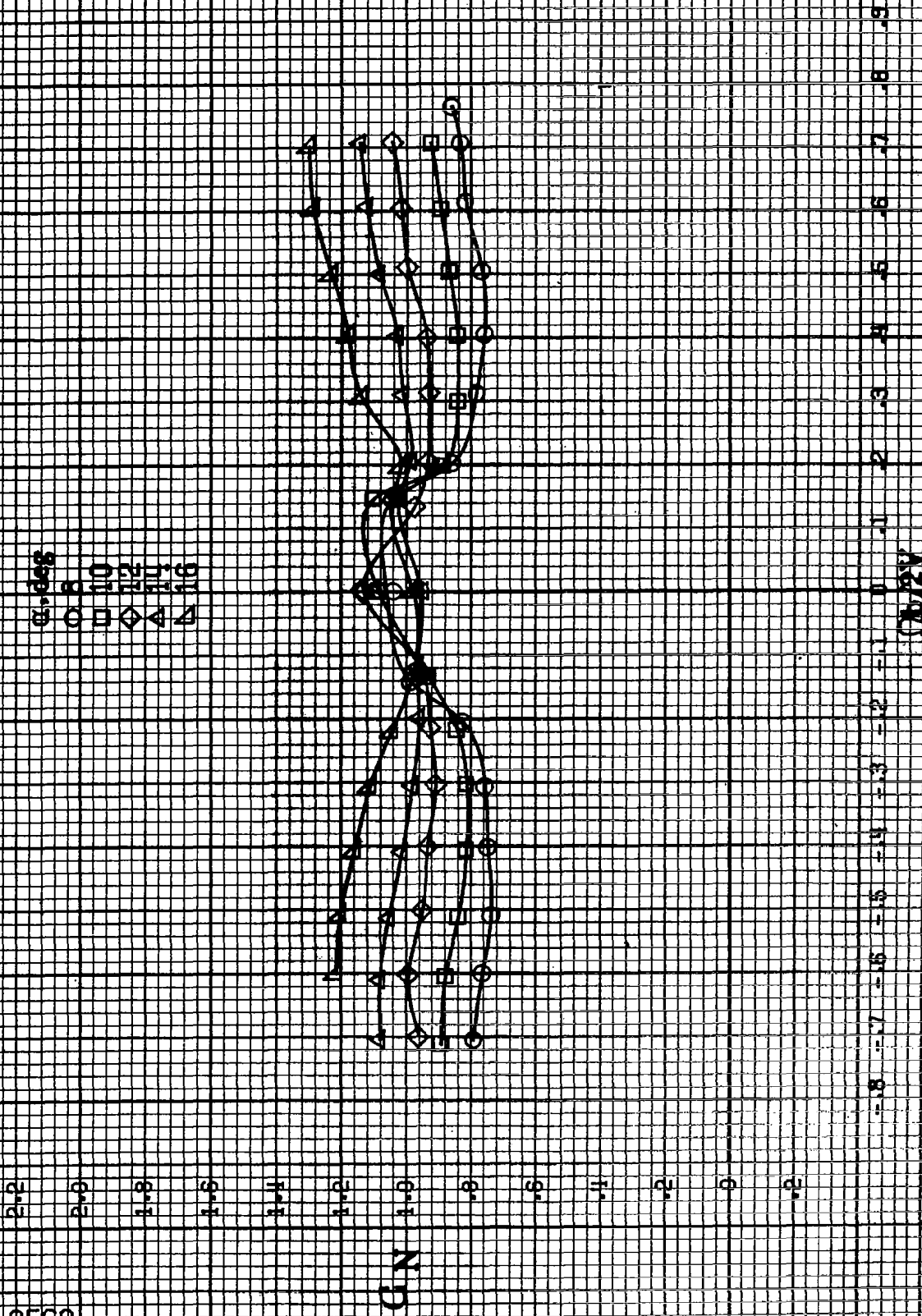
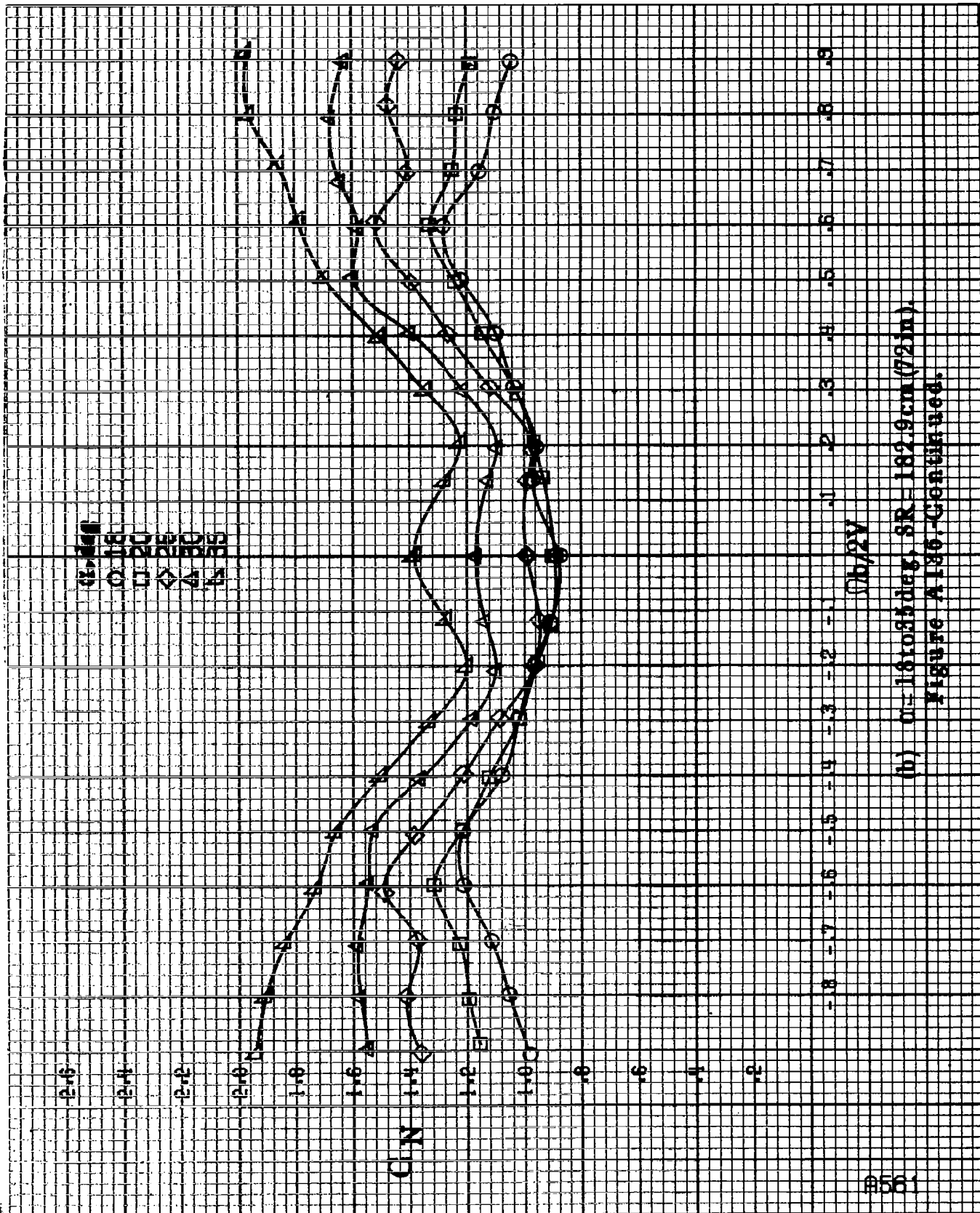


Figure A186-Effect of rotation rate and angle of attack on normalized force coefficient for tail configuration.  $\alpha = 8^\circ, 10^\circ, 12^\circ, 14^\circ, 16^\circ$ ;  $\beta = 0^\circ$ .



(b)  $\alpha = 16$  to  $35$  deg,  $SR = 182.9$  cm (72 in).  
Figure A186. Continued.

A562

3.0

2.8

2.6

2.4

2.2

2.0

1.8

1.6

1.4

1.2

1.0

.8

.6

C.N

$\theta$ , deg

○ 30

□ 35

◇ 40

△ 45

▲ 50

.9

.8

.7

.6

.5

.4

.3

.2

.1

0

-1

-2

-3

-4

-5

-6

-7

-8

$\phi_b/2V$

(c)  $\alpha = 30$  to  $50$  deg,  $SR = 0$ .  
Figure A196.-Continued.

$\sigma$ , deg  
 55  
 60  
 70  
 80  
 90

C/N

-8 -7 -6 -5 -4 -3 -2 -1 0 .1 .2 .3 .4 .5 .6 .7 .8 .9  
 $m/2V$

(d)  $n=5$  to  $90$  deg,  $SR=0$ .  
 Figure A136. Concluded.

A563

8564

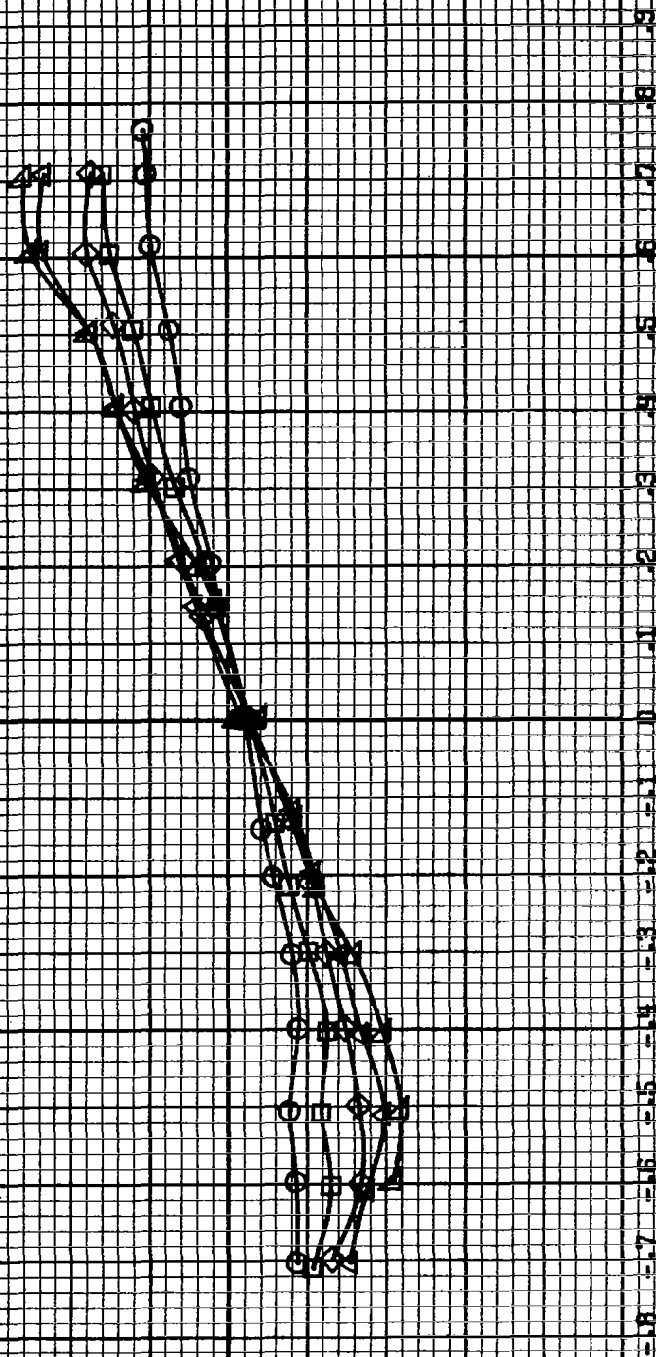
0.008  
0.010  
0.012  
0.016

$C_y$

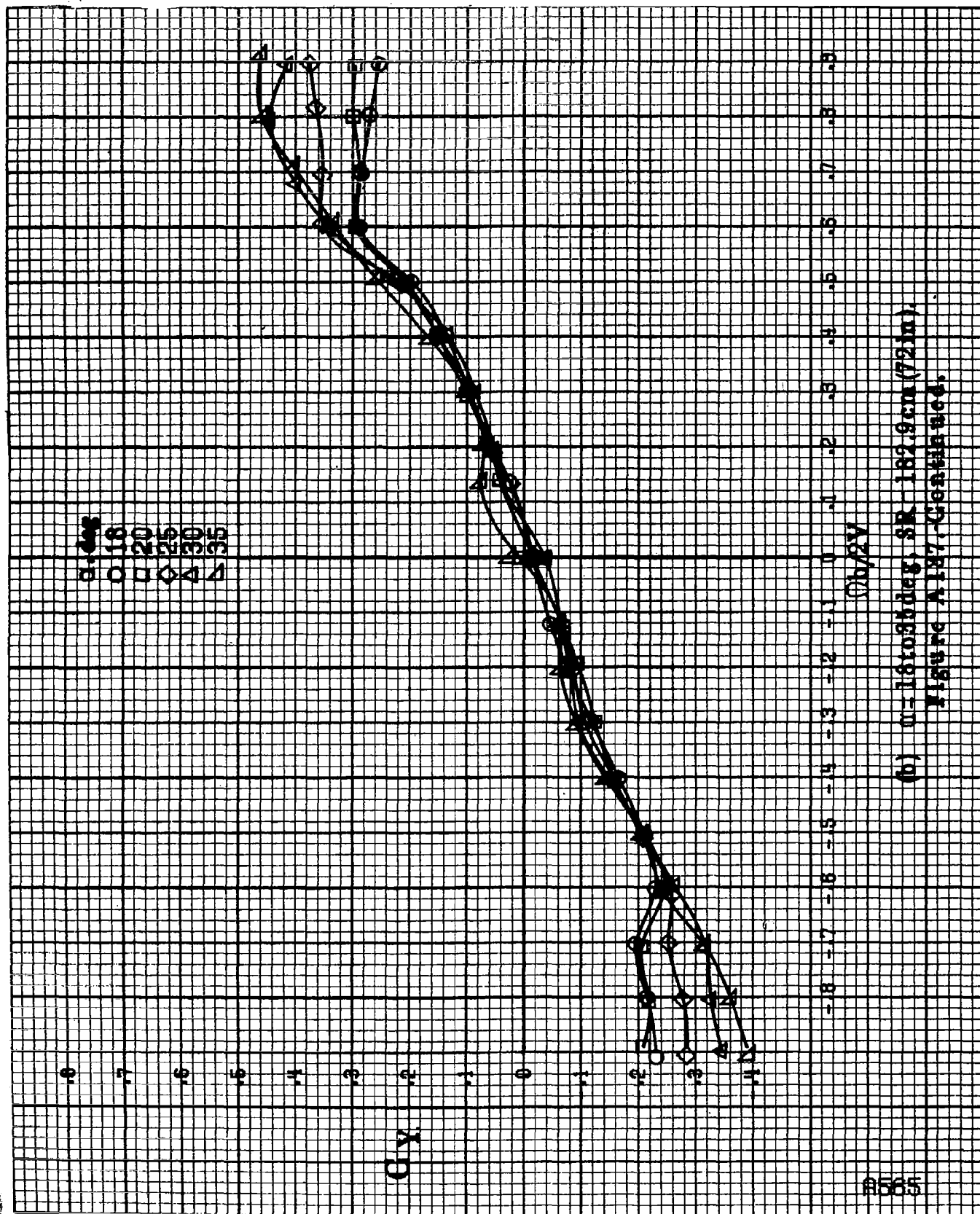
$C_{h,2V}$

(a)  $\beta = 84.16 \text{ deg}$ ,  $S_R = 182.8 \text{ cm}^2 (28 \text{ in}^2)$ .

Figure A.187: Effect of rotation rate and angle of attack on side-force coefficient for T-tail configuration.  $\alpha = 11^\circ$ ,  $\delta\alpha = 0^\circ$ ,  $\delta\gamma = 0^\circ$ ,  $\theta = 0^\circ$ .







(b)  $\alpha = 16$  to  $35^\circ$ , SR - 182.9 cm (72 in).  
 Figure A187. Continued.

8566

0

0.1

0.2

0.3

0.4

0.5

0.6

0.7

0.8

0.9

1.0

1.1

1.2

1.3

1.4

$C_Y$

$\alpha, \text{deg}$

30

35

40

45

50

0

0.1

0.2

0.3

0.4

0.5

0.6

0.7

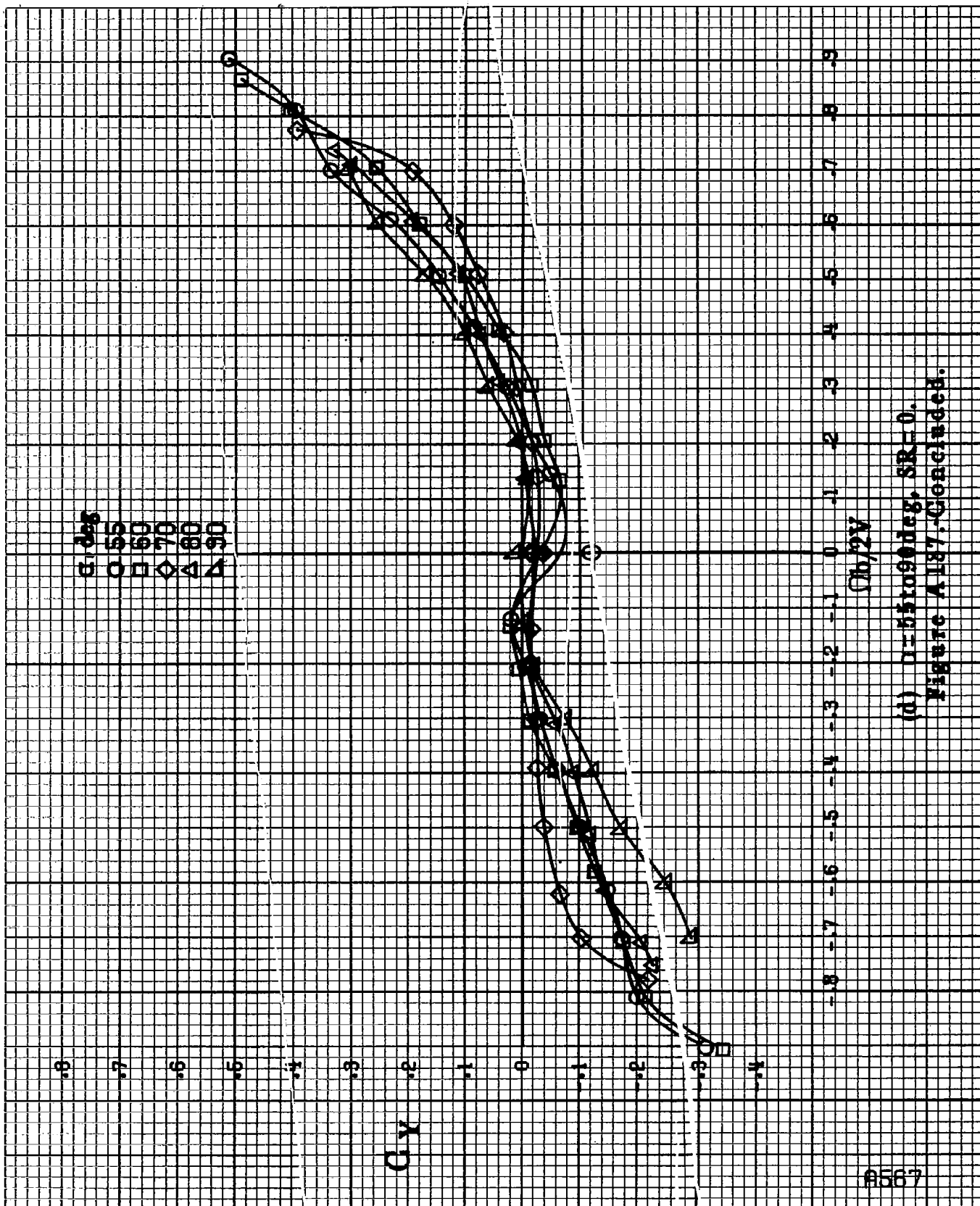
0.8

0.9

$C_{D/2V}$

(c)  $m = 80$  to  $50$  deg,  $SR = 0$ .

Figure A137-Continued.



(d)  $\delta = 55$  to  $90$  deg,  $SR = 0$ .  
Figure A187-Concluded.

8568

0.2 deg  
0.4 deg  
0.6 deg  
0.8 deg  
1.0 deg  
1.2 deg  
1.4 deg  
1.6 deg  
1.8 deg  
2.0 deg

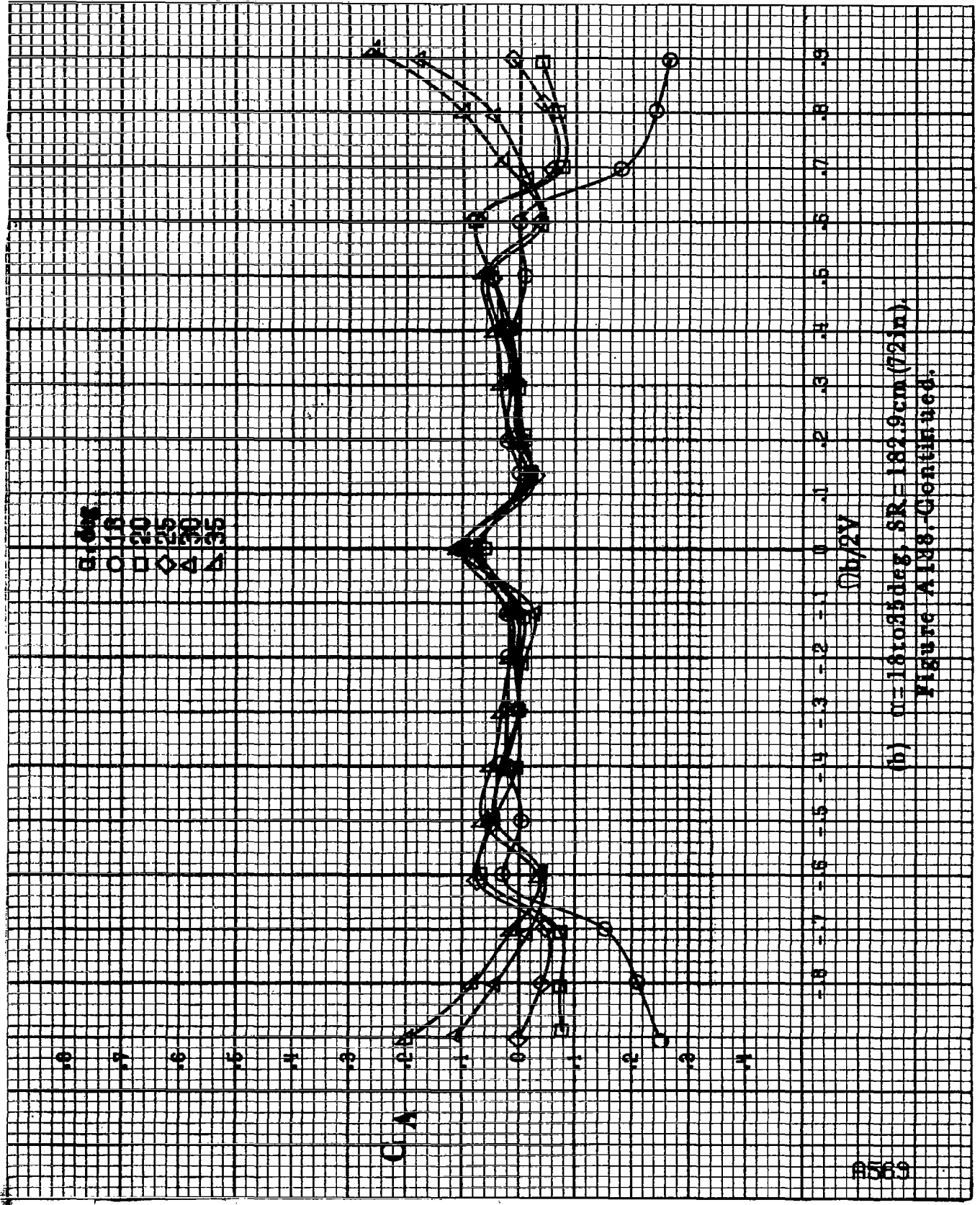
CA

-1.8 -1.7 -1.6 -1.5 -1.4 -1.3 -1.2 -1.1 0 .1 .2 .3 .4 .5 .6 .7 .8 .9

100.2V

(a)  $\alpha = 8$  to  $16$  deg,  $\beta R = 1.82$  cm (7.2 in).

Figure A186.-Effect of rotation rate and angle of attack on axial force coefficient for T-tail configuration.  $\phi = 0$ ,  $\delta_1 = 0$ ,  $\delta_2 = 0$ ,  $\beta = 3^\circ$ .



(b)  $\alpha = 18.083 \text{ deg}$ ,  $SR = 182.9 \text{ cm (72 in)}$ .

Figure A138. Continued.

8570

0

.1

.2

.3

.4

.5

.6

.7

.8

.9

1.0

1.1

1.2

1.3

1.4

1.5

1.6

1.7

$\alpha$ , deg

30

35

40

45

50

G.A

0

.1

.2

.3

.4

.5

.6

.7

.8

.9

1.0

$\Omega_b/2V$

0

.1

.2

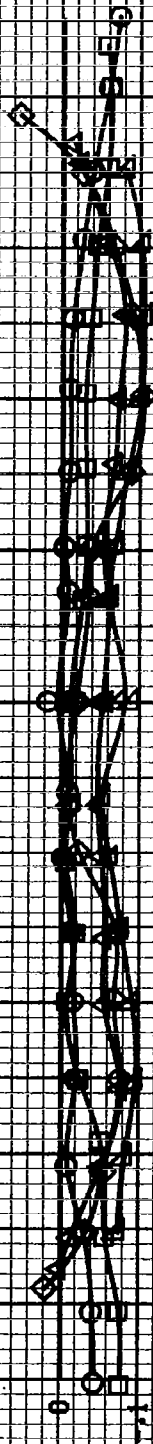
.3

(c)  $\mu=30$  to  $50$  deg,  $SR=0$ .

Figure A193-Continued.

a. days  
 ○ 55  
 □ 60  
 ◇ 70  
 △ 80  
 ▲ 90

Q.A. 2

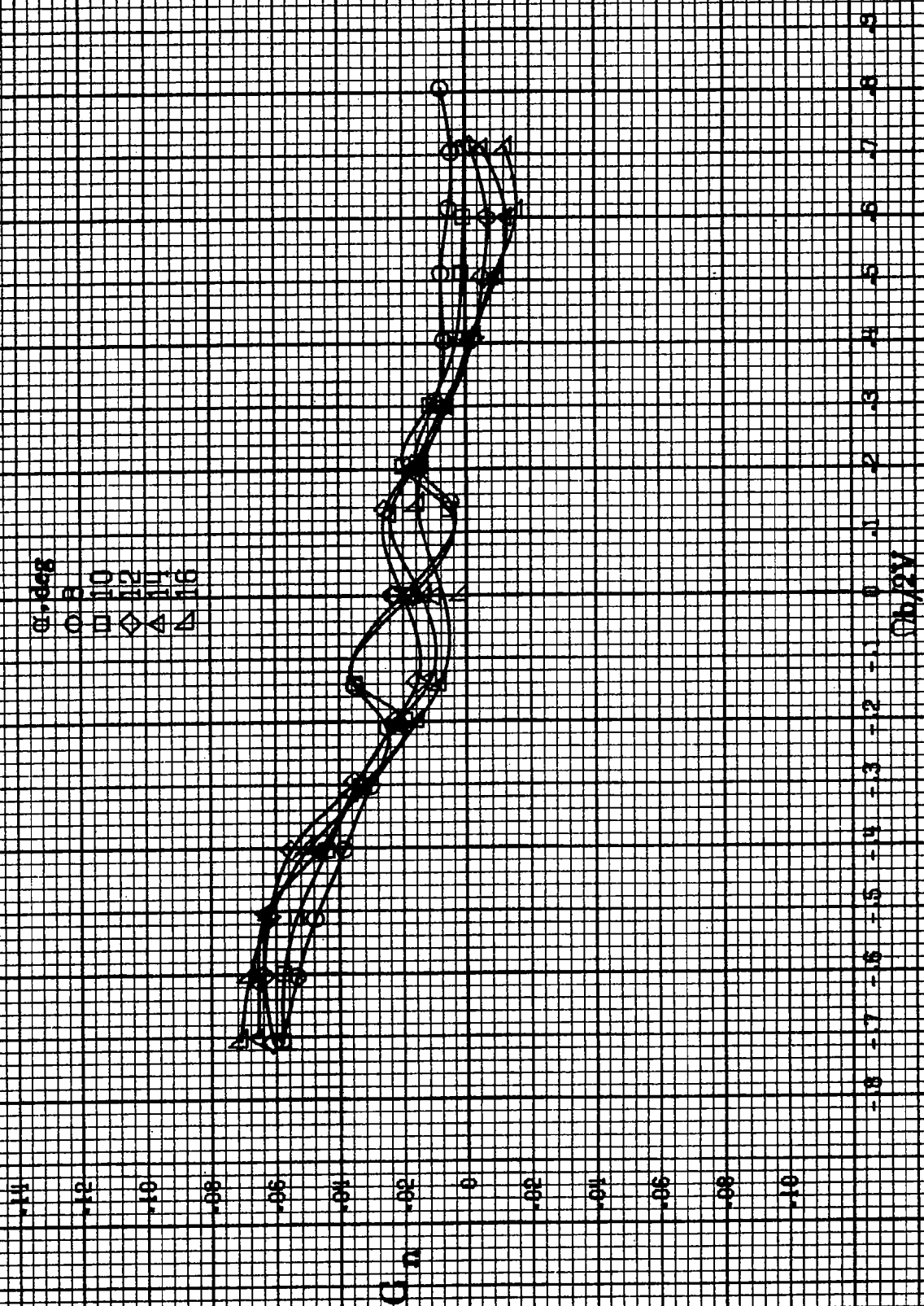


Oh/2V

(d)  $\eta = 55$  to  $90$  deg,  $SR = 0$ .  
 Figure A188. Concluded.

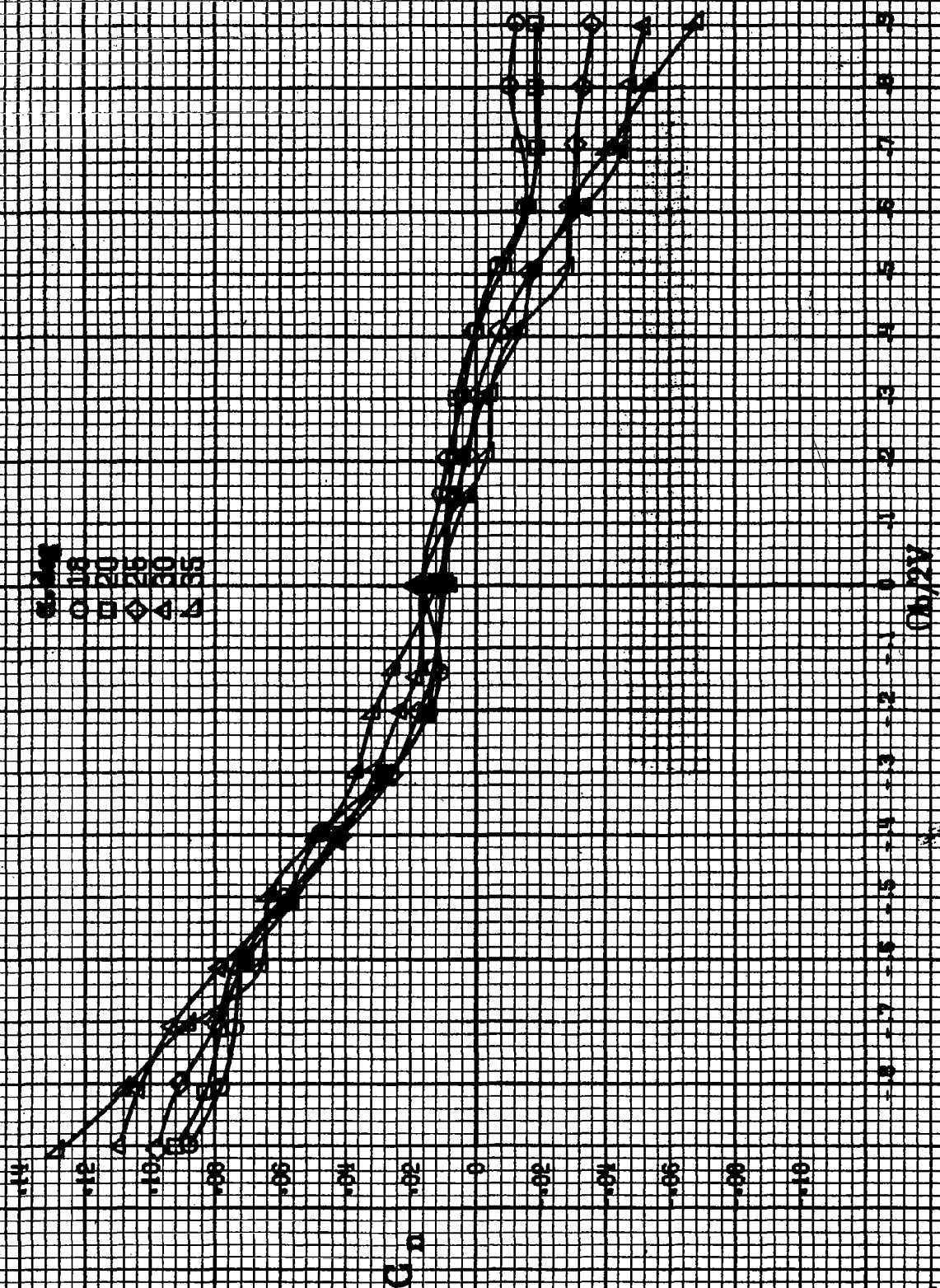
A571

8572



(a)  $\alpha = 86.16$  deg,  $SR = 1.92$  gem (72 in).  
 Figure A129.-Effect of rotation rate and angle of attack on yawing moment coefficient for T-tail configuration.  $\delta a = -1.5^\circ$ ,  $\delta a = 0^\circ$ ,  $\delta a = 2.5^\circ$ ,  $\delta a = 5^\circ$ .





(h)  $n=18, 20, 25, 30, 35$ ;  $SR=162.9 \text{ cm (72 in.)}$   
 Figure A189. Continued.

8574

$\alpha, \text{deg}$   
 ○ 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▲ 50

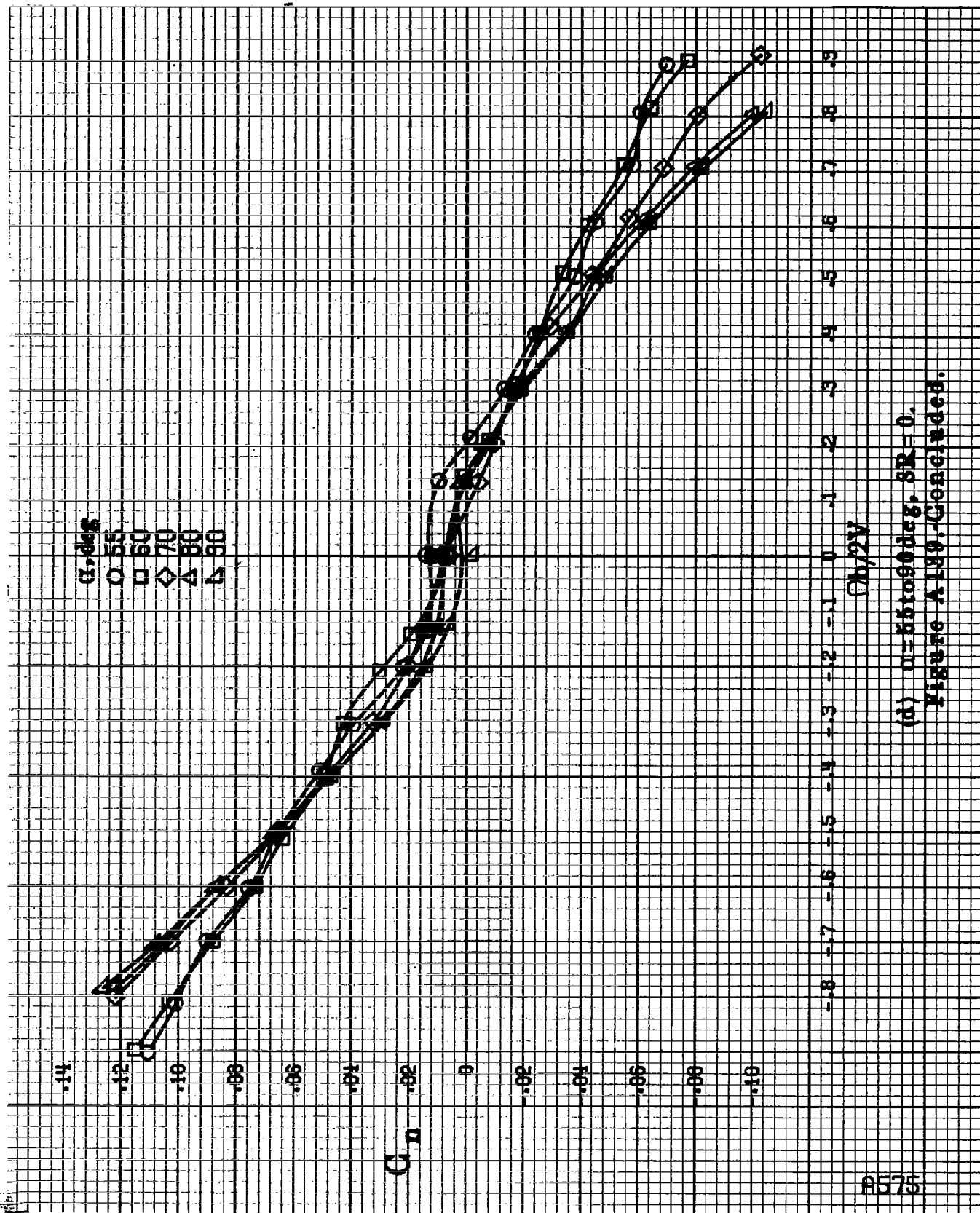
$G_n$

$\Omega b/2V$

(c)  $\mu = 90$  to  $50$  deg,  $SR = 0$ .  
 Figure A189. Continued.

.14  
 .12  
 .10  
 .08  
 .06  
 .04  
 .02  
 0  
 -.02  
 -.04  
 -.06  
 -.08  
 -.10

-.8 -.7 -.6 -.5 -.4 -.3 -.2 -.1 0 .1 .2 .3 .4 .5 .6 .7 .8 .9



(d)  $\alpha=55$  to  $90$  deg,  $SR=0$ .  
Figure A139. Continued.

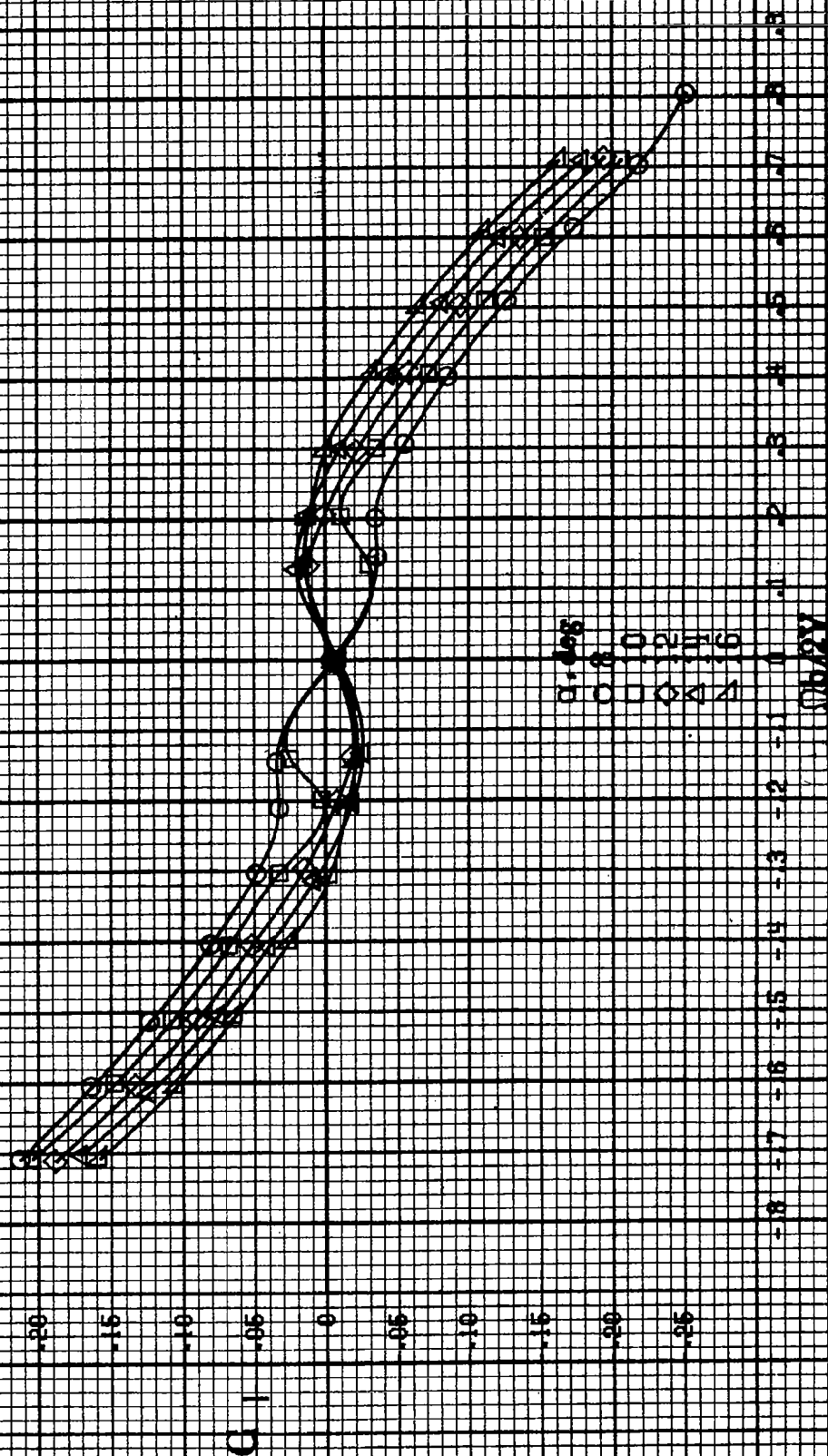
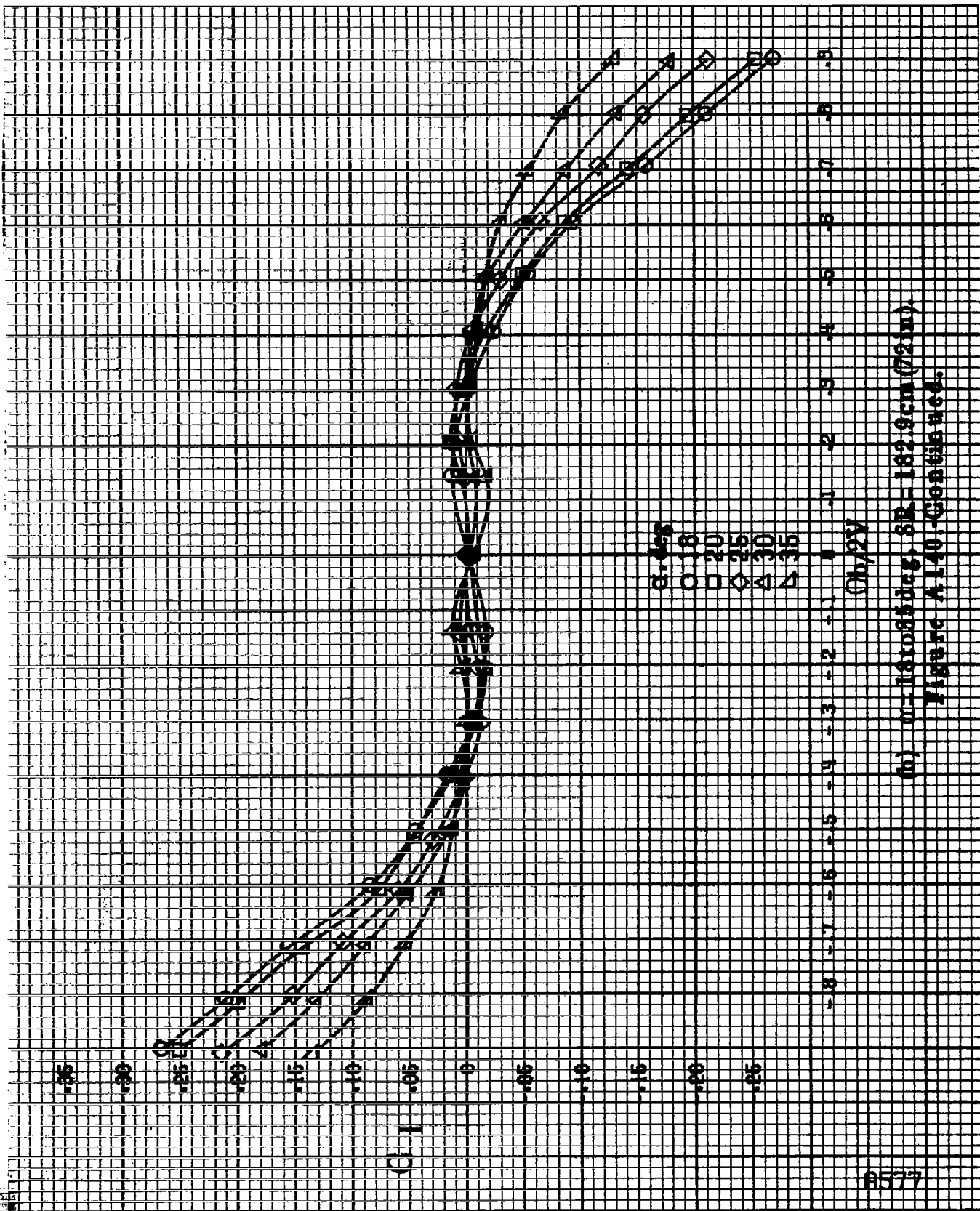
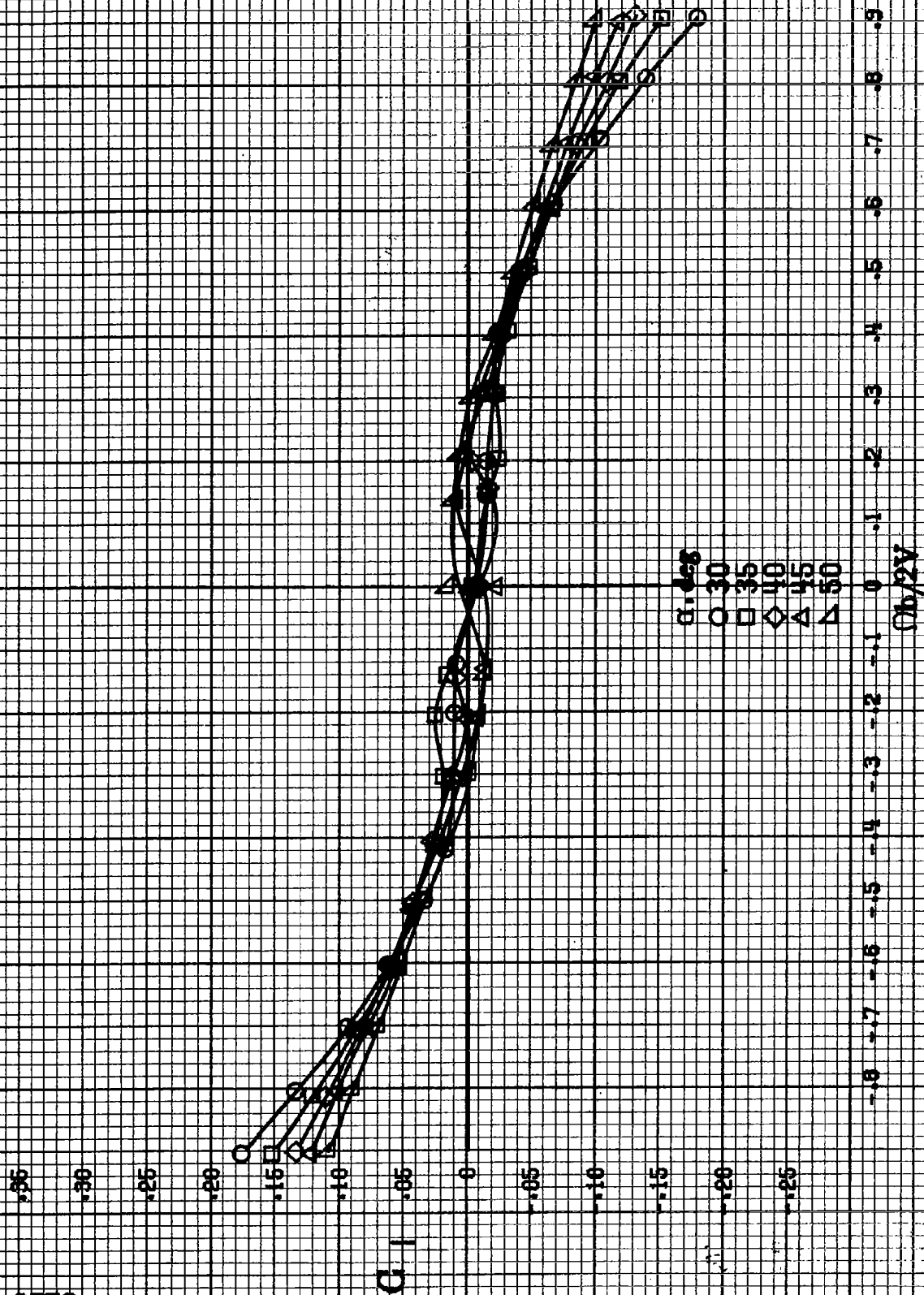


Figure A140-Effect of rotation rate and angle of attack on rolling moment coefficient for T-tail configuration.  $\delta_a = 0^\circ$ ,  $\delta_r = -25^\circ$ ,  $\delta = 0^\circ$ .

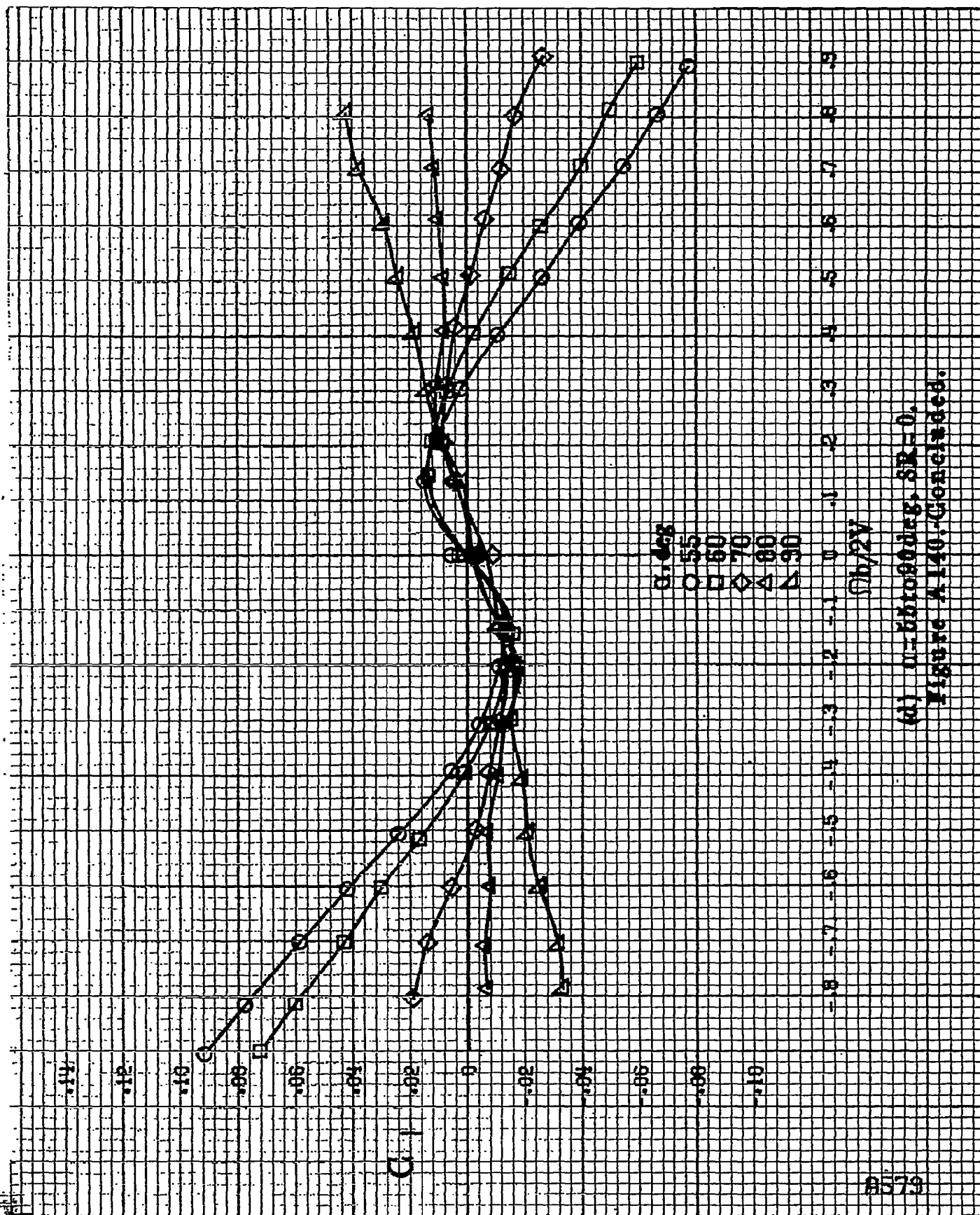


(b)  $\alpha = 16.08 \text{ deg}$ ,  $SL = 162.9 \text{ cm (72 in)}$   
Figure A.140. Continued.

8578

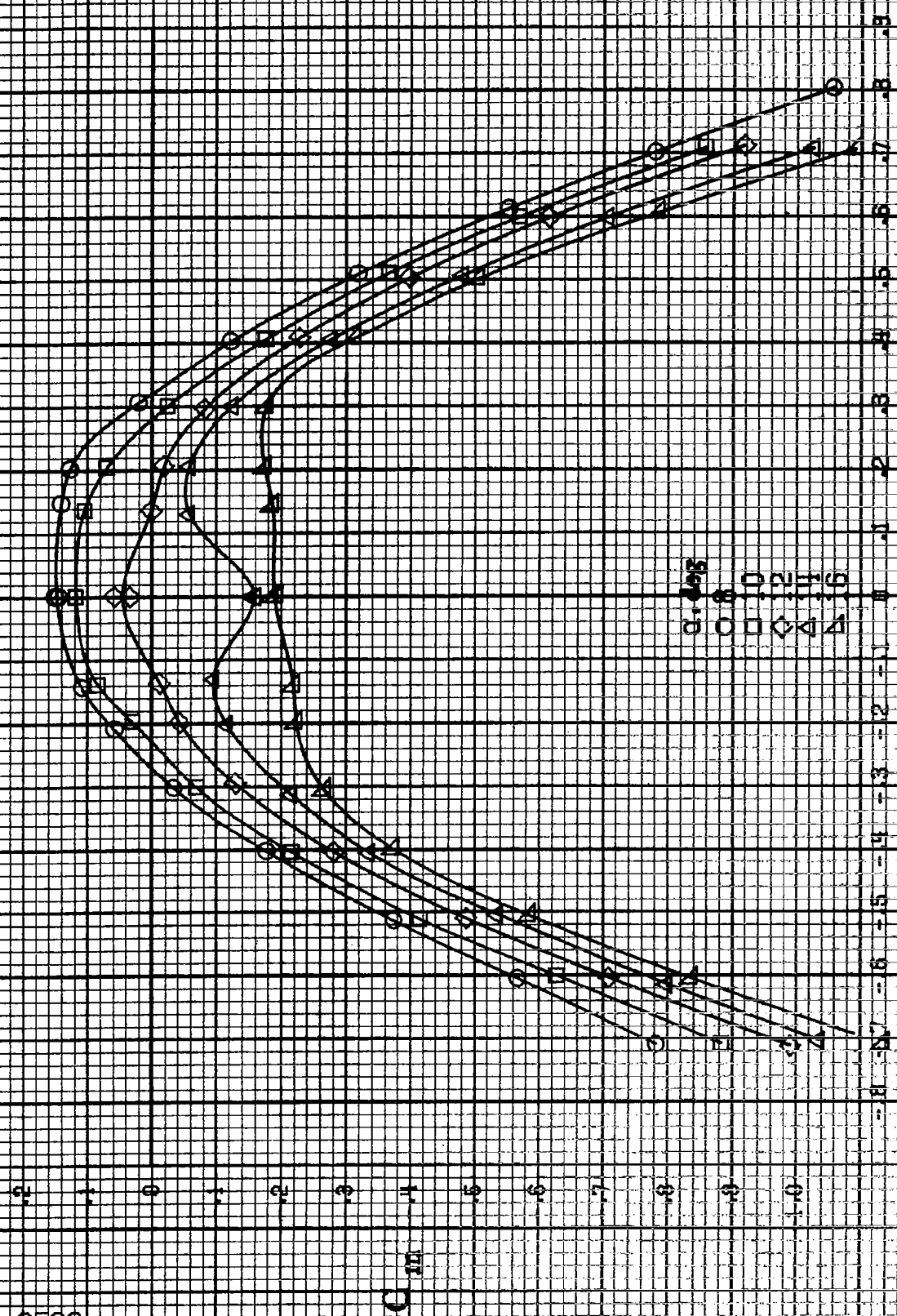


(c)  $\alpha = 30$  to  $50^\circ$ ,  $SR = 0$ .  
Figure A140.-Continued.



(d) p-nitrophenol,  $SR=0$ .  
Figure A140. Continued.

#580

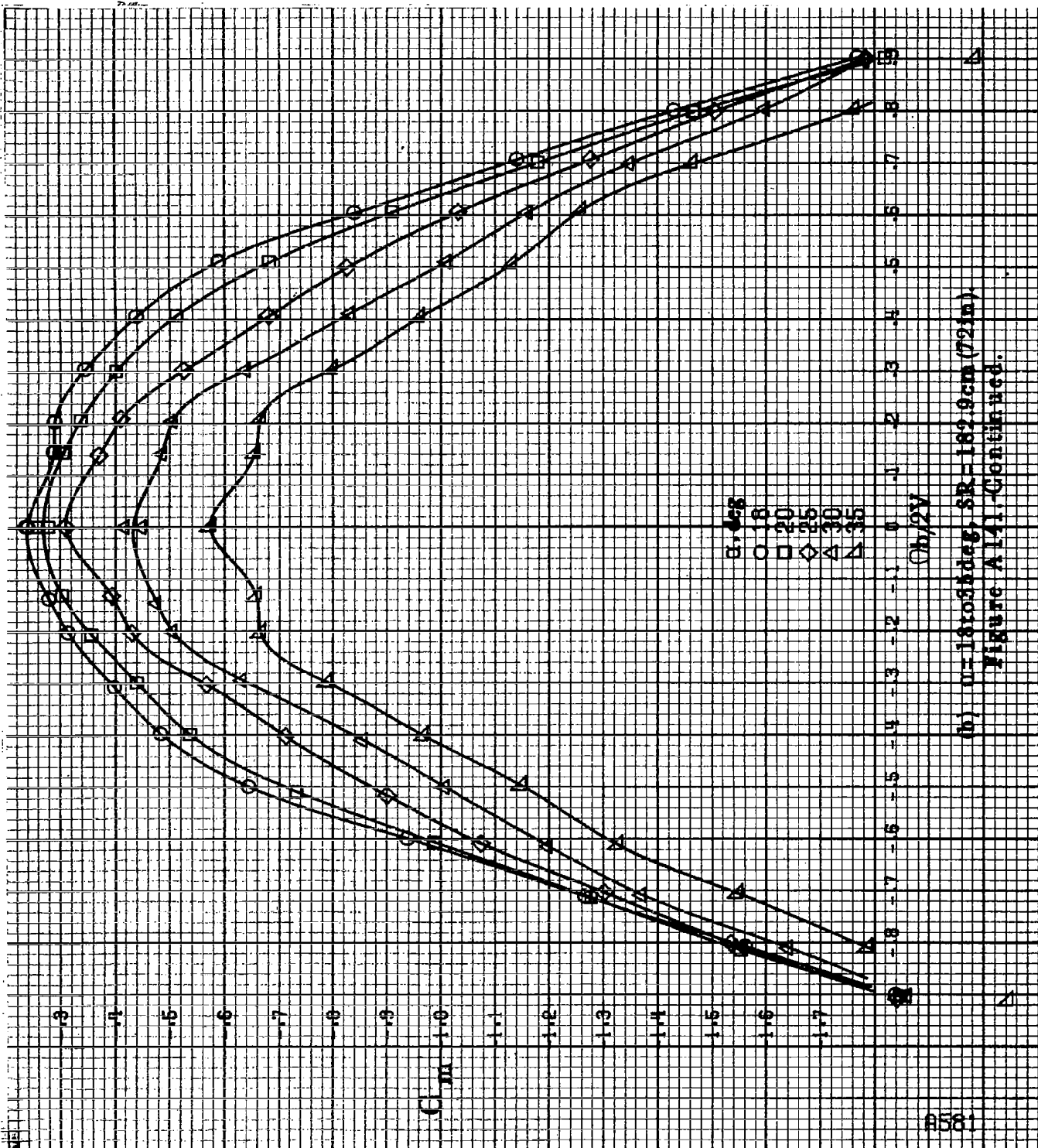


$C_{L,2V}$

(a)  $\alpha = 8^\circ$  to  $16^\circ$ ,  $S.R. = 1.32$ ,  $g = 1.21e$ .

Figure A141: Effect of rotation rate and angle of attack on pitching moment coefficient for F-101 configuration.  $S_e = 16^\circ$ ,  $\delta_a = 0^\circ$ ,  $\delta_r = 25^\circ$ ,  $\beta = 10^\circ$ .





(h)  $n=16088 \text{ deg}$ ,  $SR=182.9 \text{ cm}$  (72 in)  
Figure A 141-Continued.

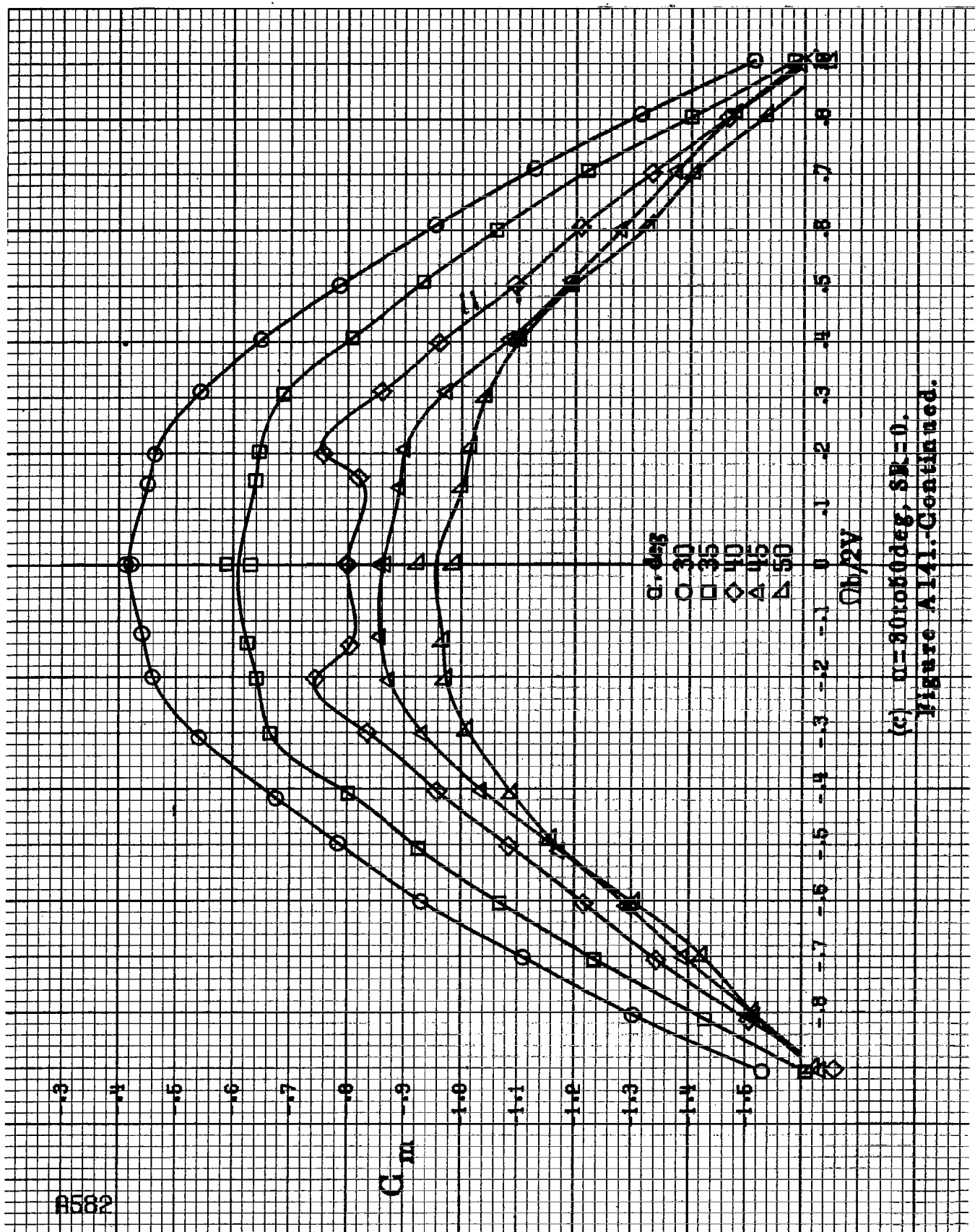
B582

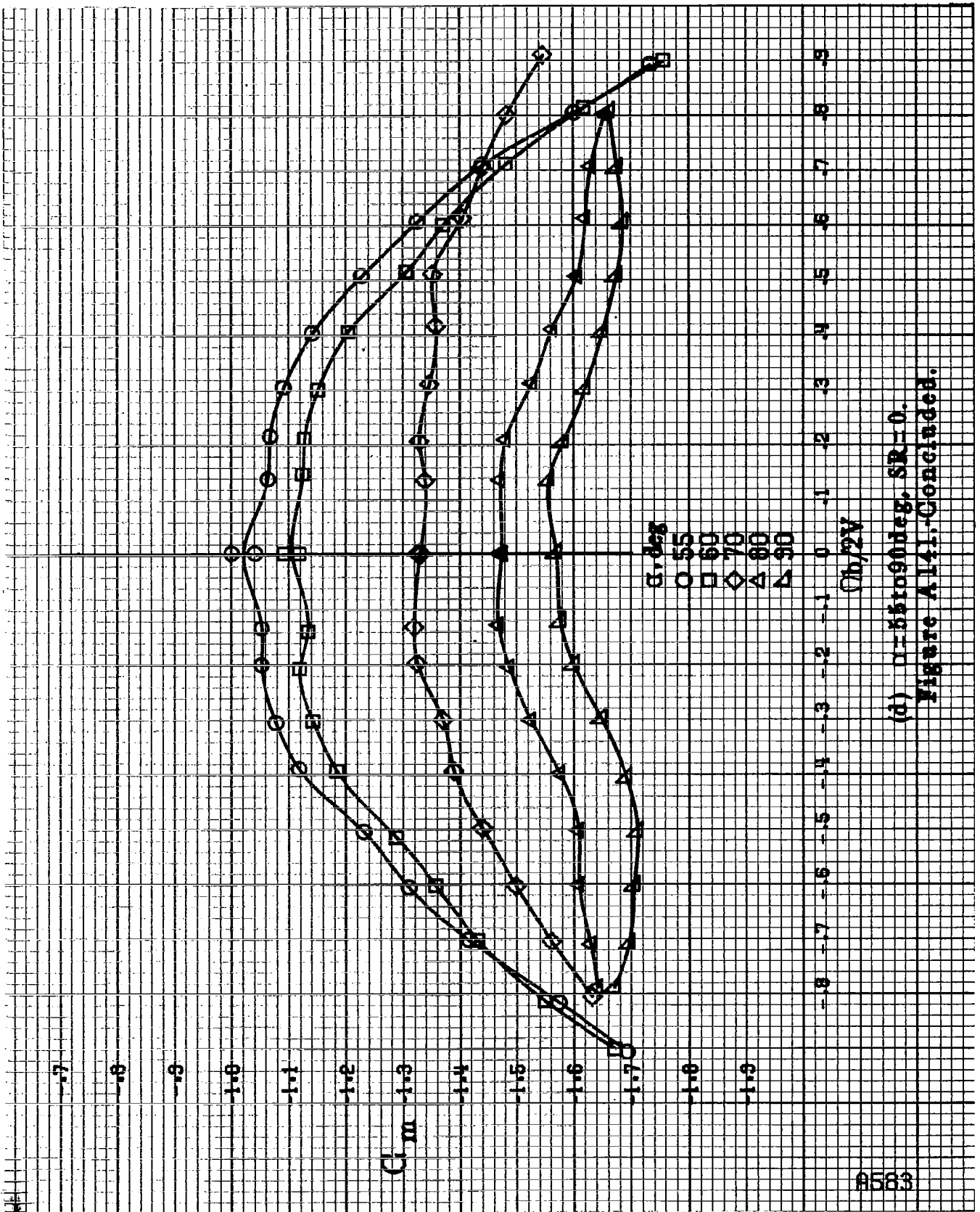
$C_m$

$\alpha, \text{deg}$   
 $\circ$  30  
 $\square$  35  
 $\diamond$  40  
 $\triangle$  45  
 $\nabla$  50

$\Omega b/2V$

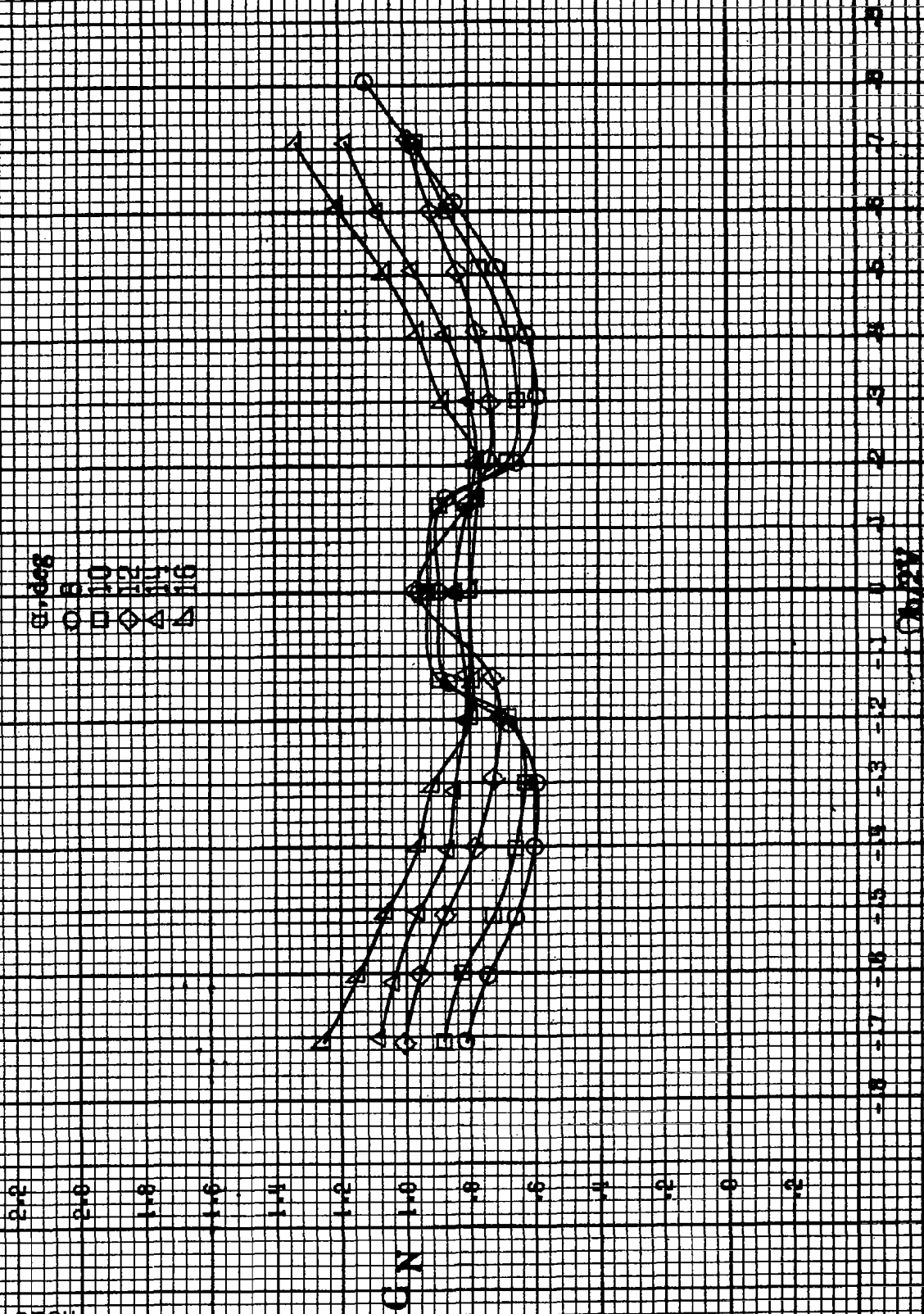
(c)  $\eta = 30 \text{ to } 60 \text{ deg}$ ,  $SR = 0$ .  
 Figure A141. Continued.



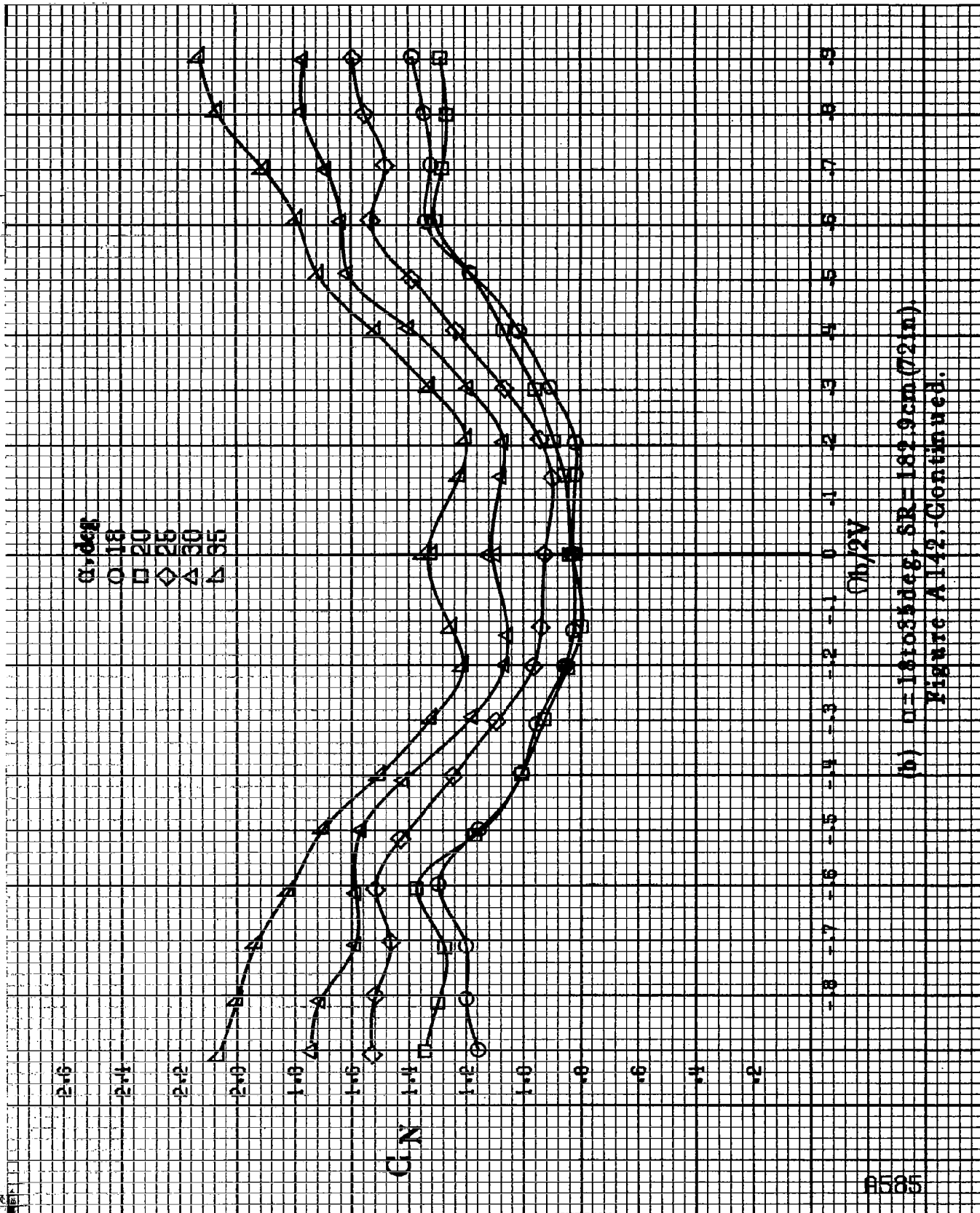


(d)  $\alpha=55$  to  $90 \text{ deg}$ ,  $SR=0$ .  
Figure A141.-Concluded.

B584

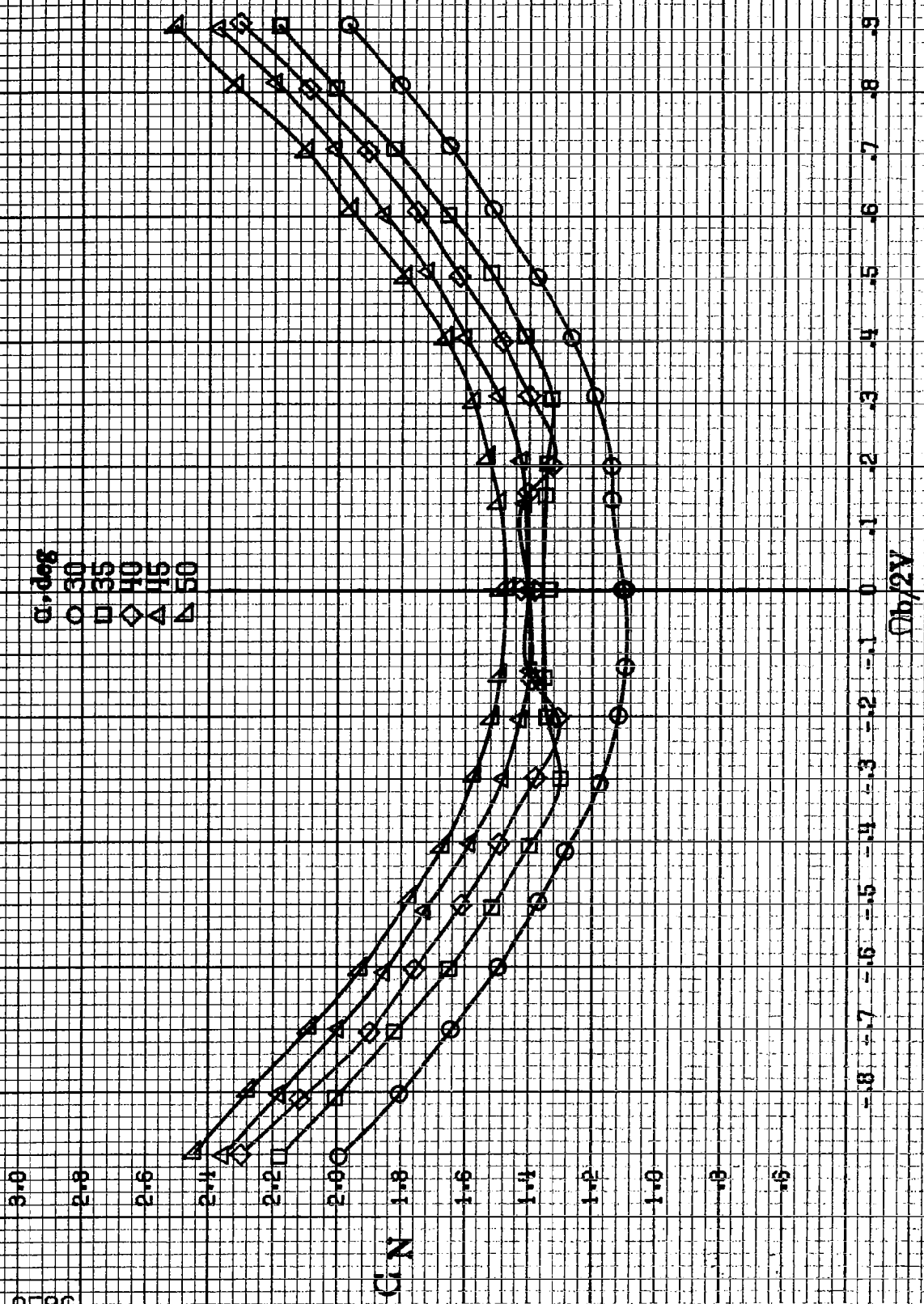


(e)  $\alpha = 8^\circ$  to  $16^\circ$ ,  $SR = 1.92$ ,  $Re = 7.2 \times 10^5$ .  
 Figure A142. Effect of rotation speed and angle of attack on normalized  
 coefficient for T-tail configuration.  $Re = 1.5 \times 10^5$ ,  $SR = 2.5$ ,  $Re = 10^6$ .

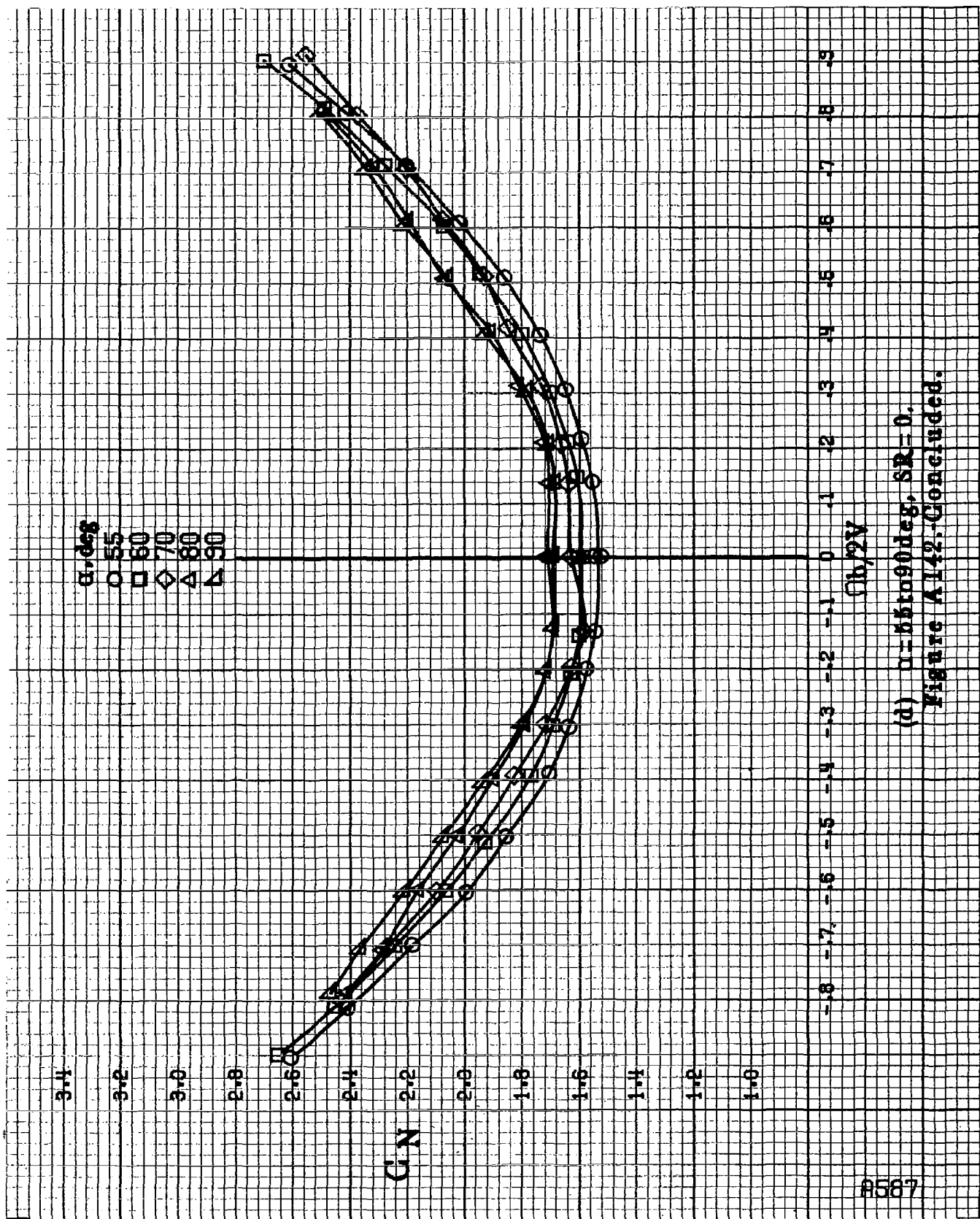


(b)  $\alpha = 18.1085 \text{ deg}$ ,  $\delta R = 182.9 \text{ cm} (72 \text{ in})$   
Figure A142-Continued.

#586



(c)  $\alpha = 30$  to  $50^\circ$ ,  $SR = 0$ .  
Figure A142. Continued.



(d)  $\alpha = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A142. Concluded.

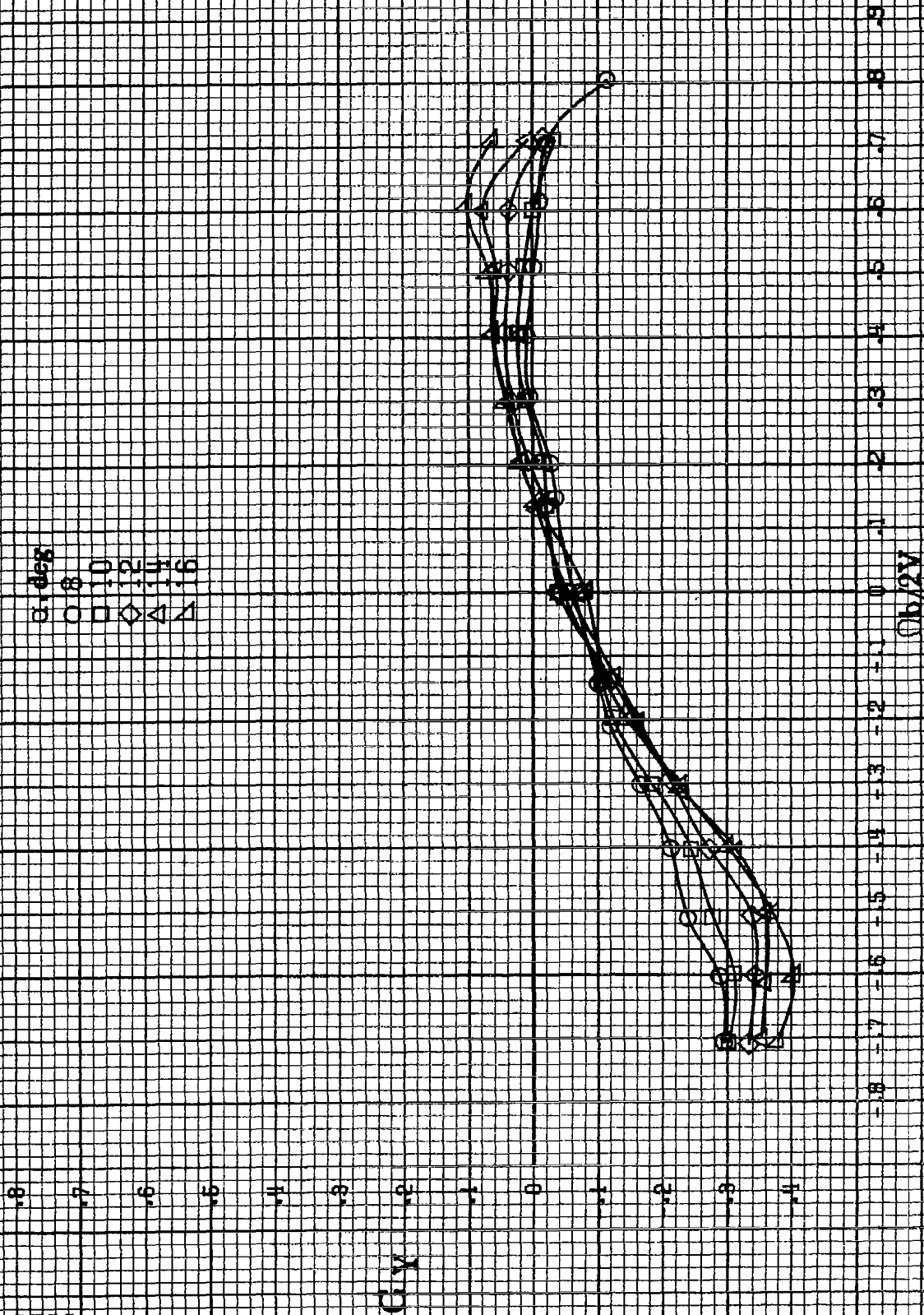
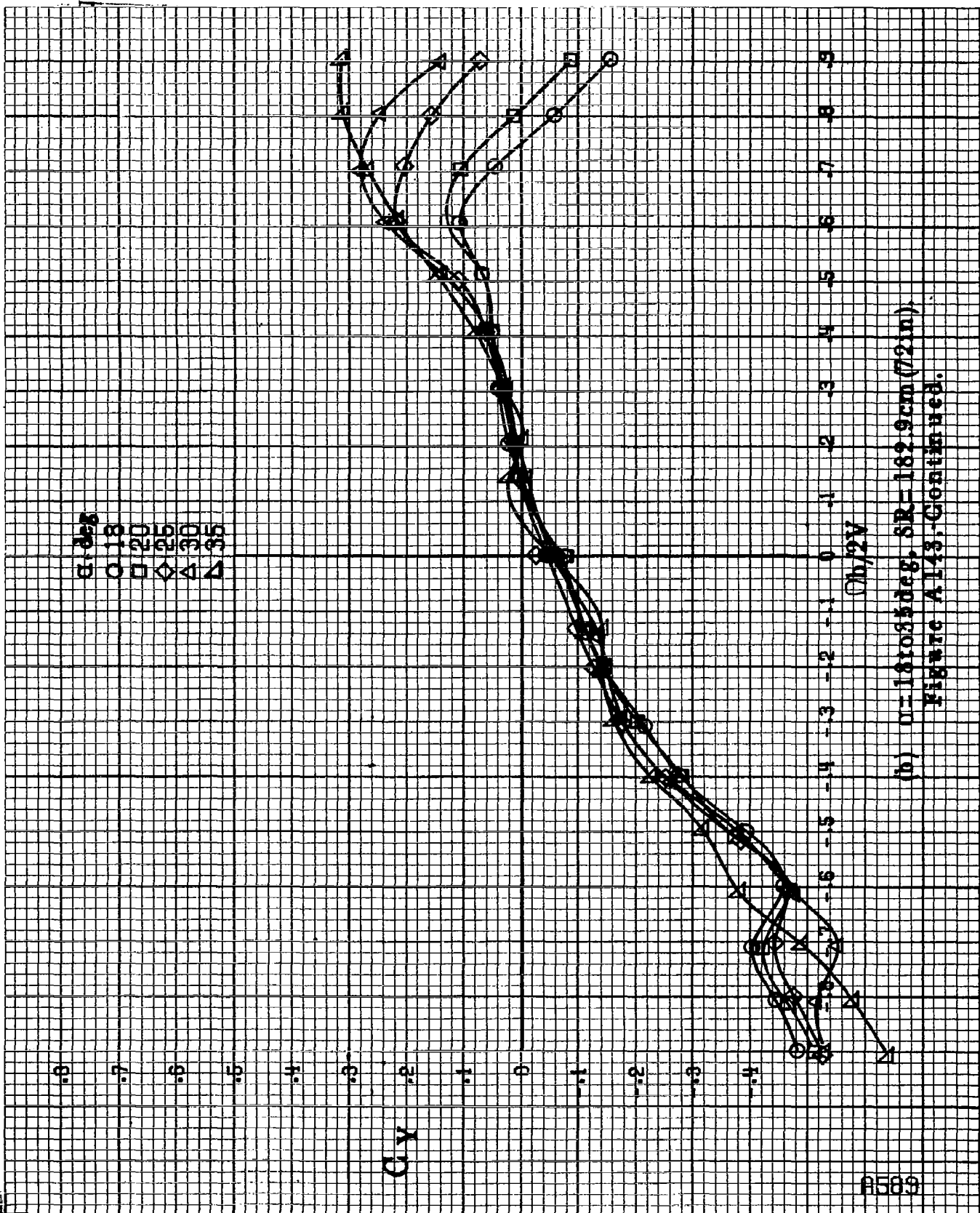


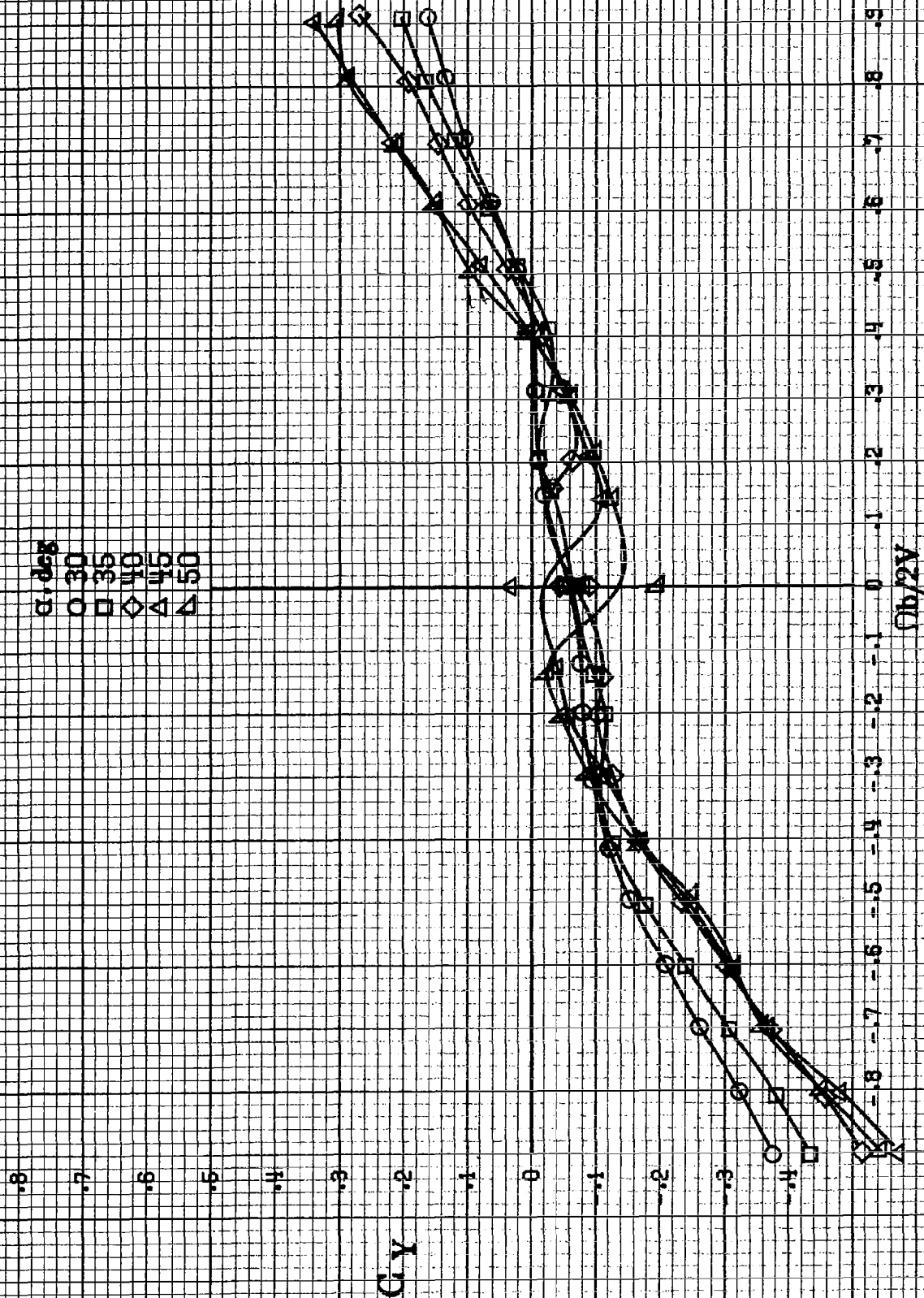
Figure A143.-Effect of rotation rate and angle of attack on sideforce coefficient for T-tail configuration.  $\delta_a = -15^\circ$ ,  $\delta_e = 0^\circ$ ,  $\delta_r = 25^\circ$ ,  $\beta = 10^\circ$ .



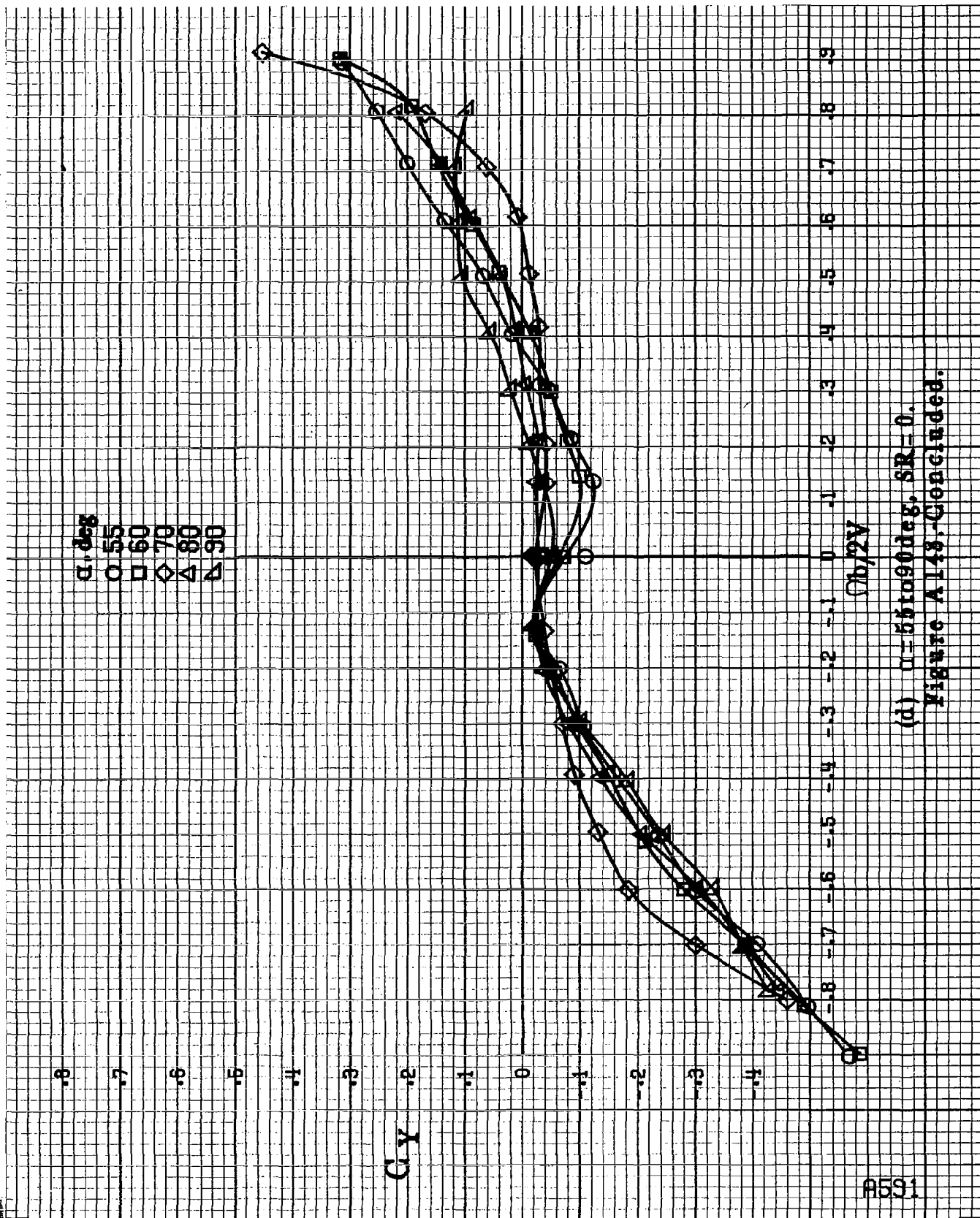


(b)  $\alpha = 16.085 \text{ deg}$ ,  $SR = 182.9 \text{ cm (7.2 in)}$ .  
 Figure A143, Continued.

9590



(c)  $\alpha = 30$  to  $50^\circ$ ,  $SR = 0$ .  
Figure A143-Continued.



(d)  $\alpha = 55$  to  $90$  deg,  $SR = 0$ .  
Figure A143-Continued.

B592

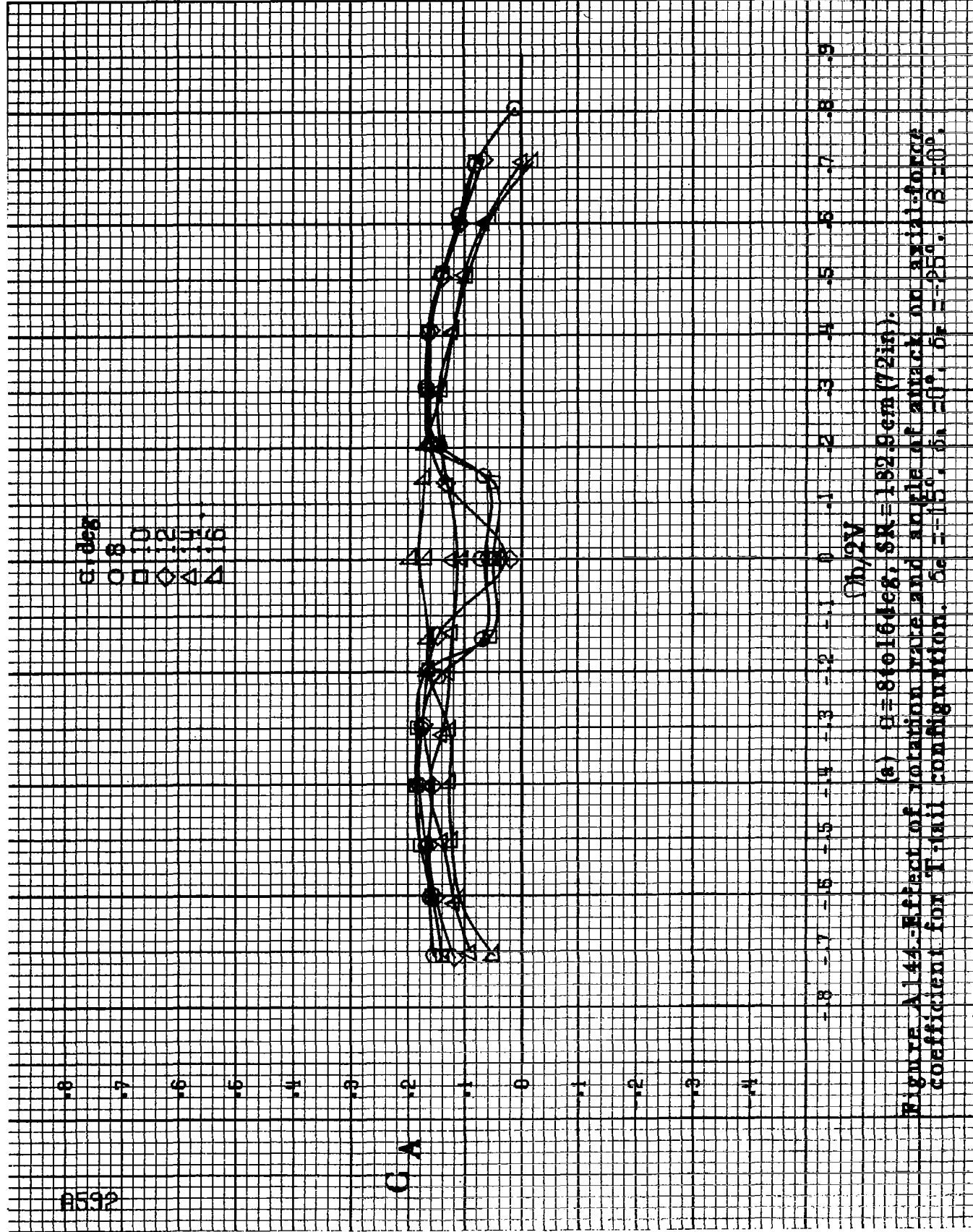
5.65%  
8.00316  
0.00316  
0.00316  
0.00316

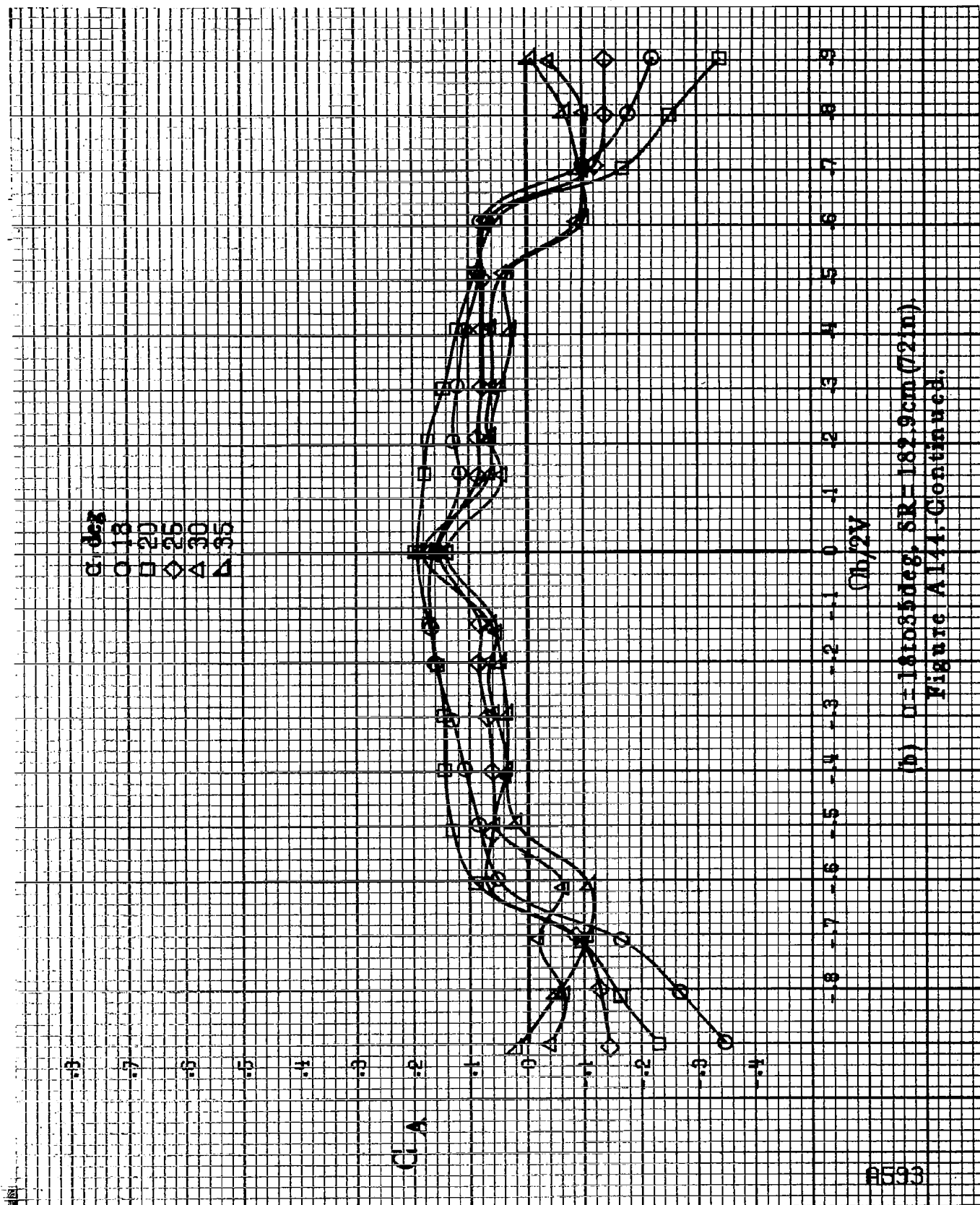
GA

$\eta, 2V$

(a)  $\alpha = 810164 \text{ deg}$ ,  $SR = 132.8 \text{ cm (72 in)}$ .

Figure A144-Effect of variation yaw and angle of attack on axial-force coefficient for T-tail configuration.  $\delta_a = 0^\circ$ ,  $\delta_r = -25^\circ$ ,  $\beta = 0^\circ$ .





(b)  $\theta = 18$  to  $85$  deg,  $SR = 182.9 \text{ cm (72 in)}$

Figure A144. Continued.

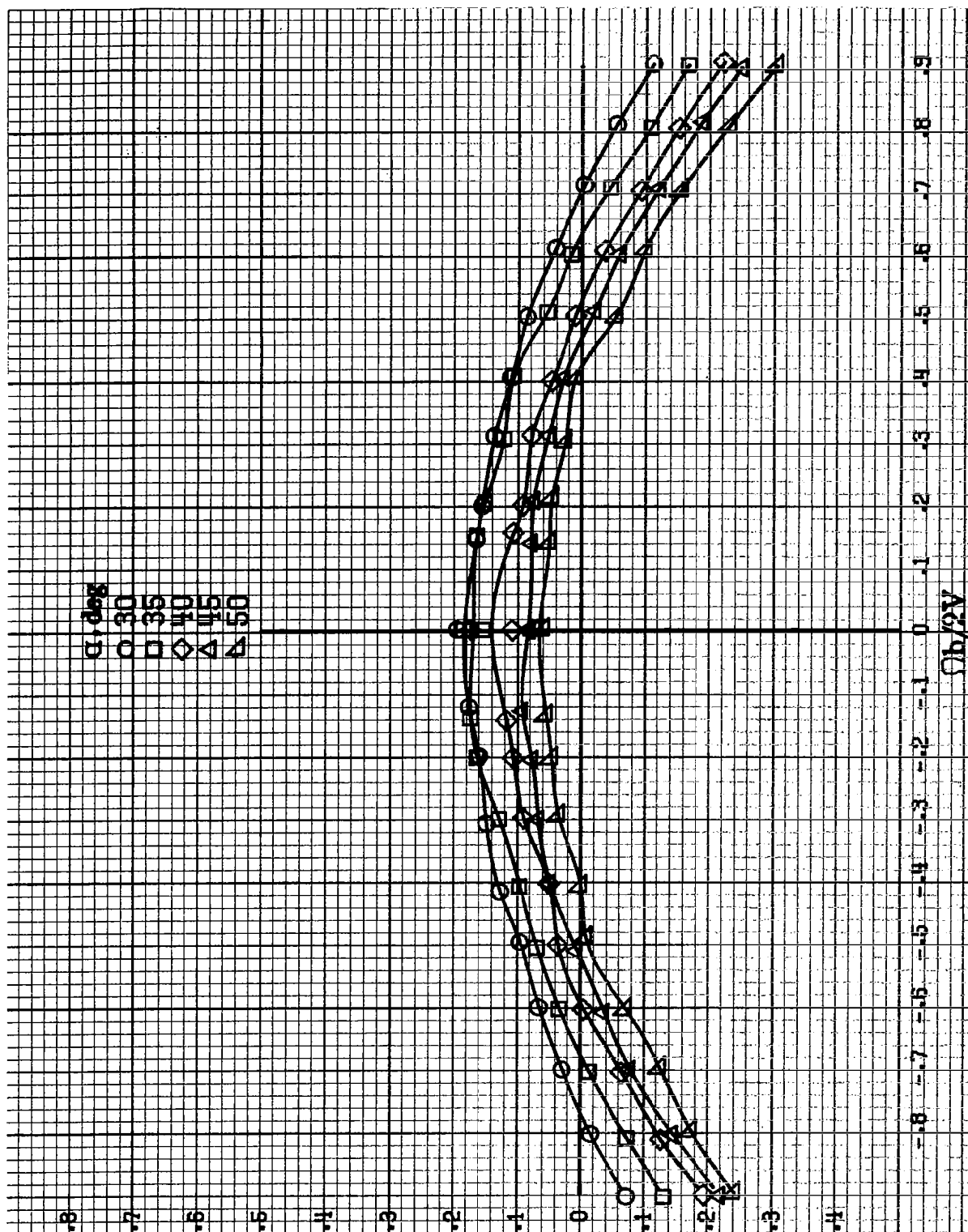
9594

$\alpha$ , deg  
 O 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▲ 50

$C_A$

$\Omega b/2V$

(c)  $\Omega = 50$  to  $500$  deg,  $SR = 0$ .  
 Figure A144-Continued.



$\alpha$ , deg  
 O 55  
 □ 60  
 ◇ 70  
 △ 80  
 ▲ 90

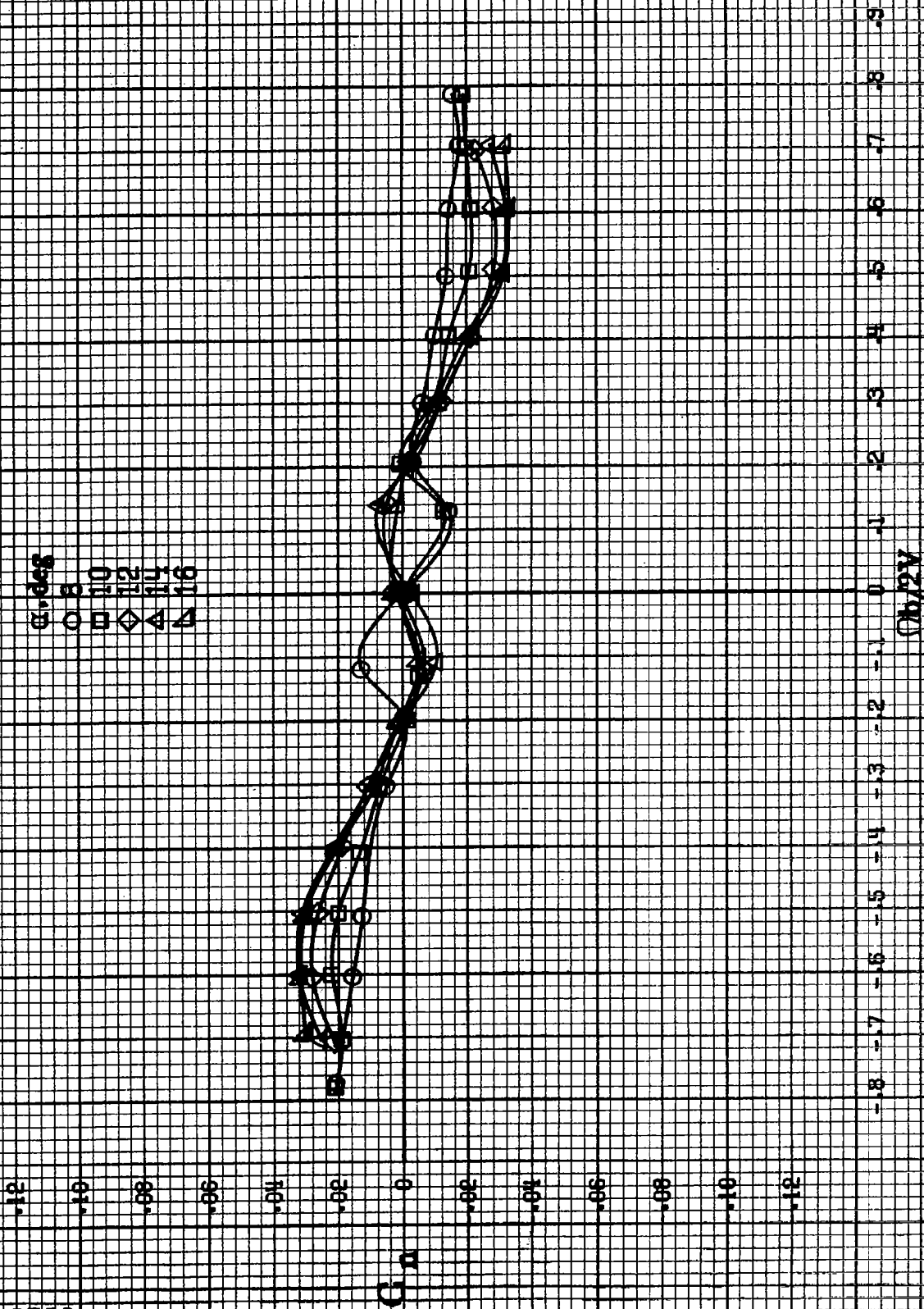
$C_A$

$C_h/2V$

(d)  $\alpha=55$  to  $90$  deg,  $SR=0$ .  
 Figure A144-Continued.

R595

8596



(a)  $\alpha = 8$  to  $16$  deg,  $SR = 132.8$  cm (72 in).  
 Figure A145.-Effect of rotation rate and angle of attack on yawing moment coefficient for no. 1 horizontal tail configuration.  $\delta = 0^\circ$ ,  $\delta = 0^\circ$ ,  $\delta = 0^\circ$ ,  $\delta = 0^\circ$ ,  $\delta = 0^\circ$ .  
 $\delta = 0^\circ$ .



$\alpha, \text{deg}$   
 ○ 18  
 □ 30  
 ◇ 35  
 △ 50  
 ▲ 55

.12  
.10  
.08  
.06  
.04  
.02  
0  
-.02  
-.04  
-.06  
-.08  
-.10  
-.12

$C_{11}$

-.8 -.7 -.6 -.5 -.4 -.3 -.2 -.1 0 .1 .2 .3 .4 .5 .6 .7 .8 .9

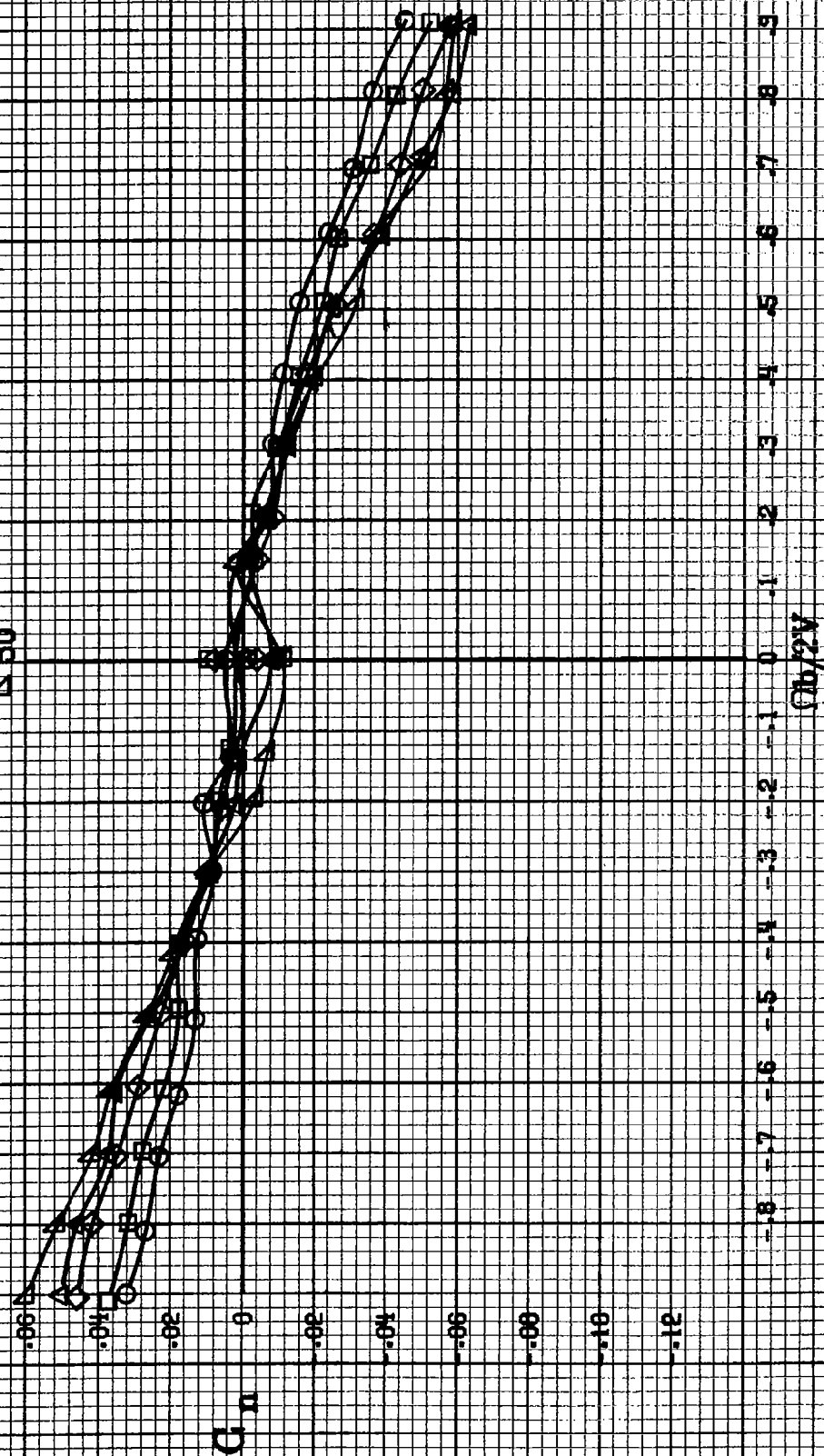
$(\sigma_b/2V)$

(b)  $n=1.81035 \text{deg}$ ,  $SR=182.9 \text{cm}$  (72 in).  
 Figure A14b. Continued.

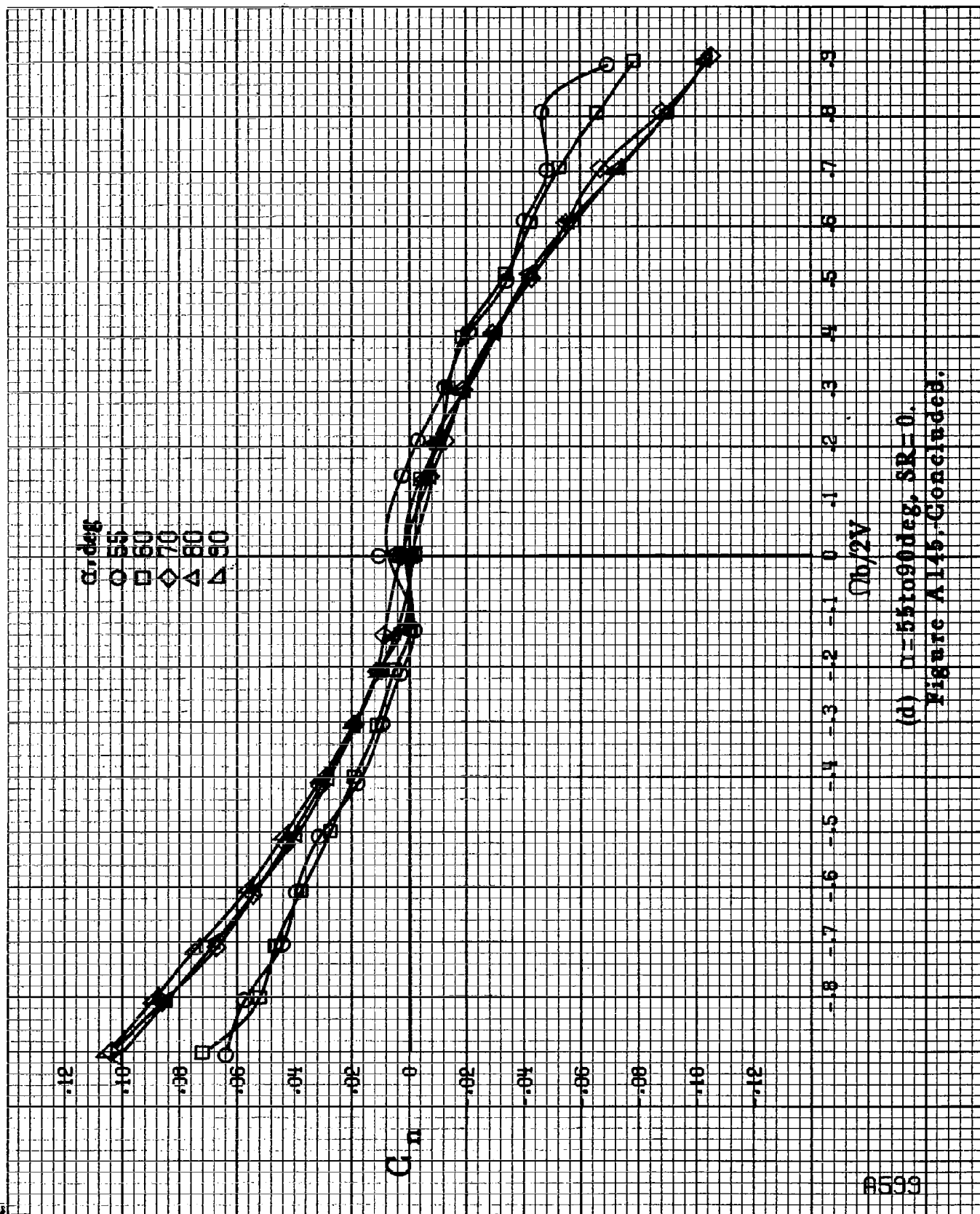
A537

A598

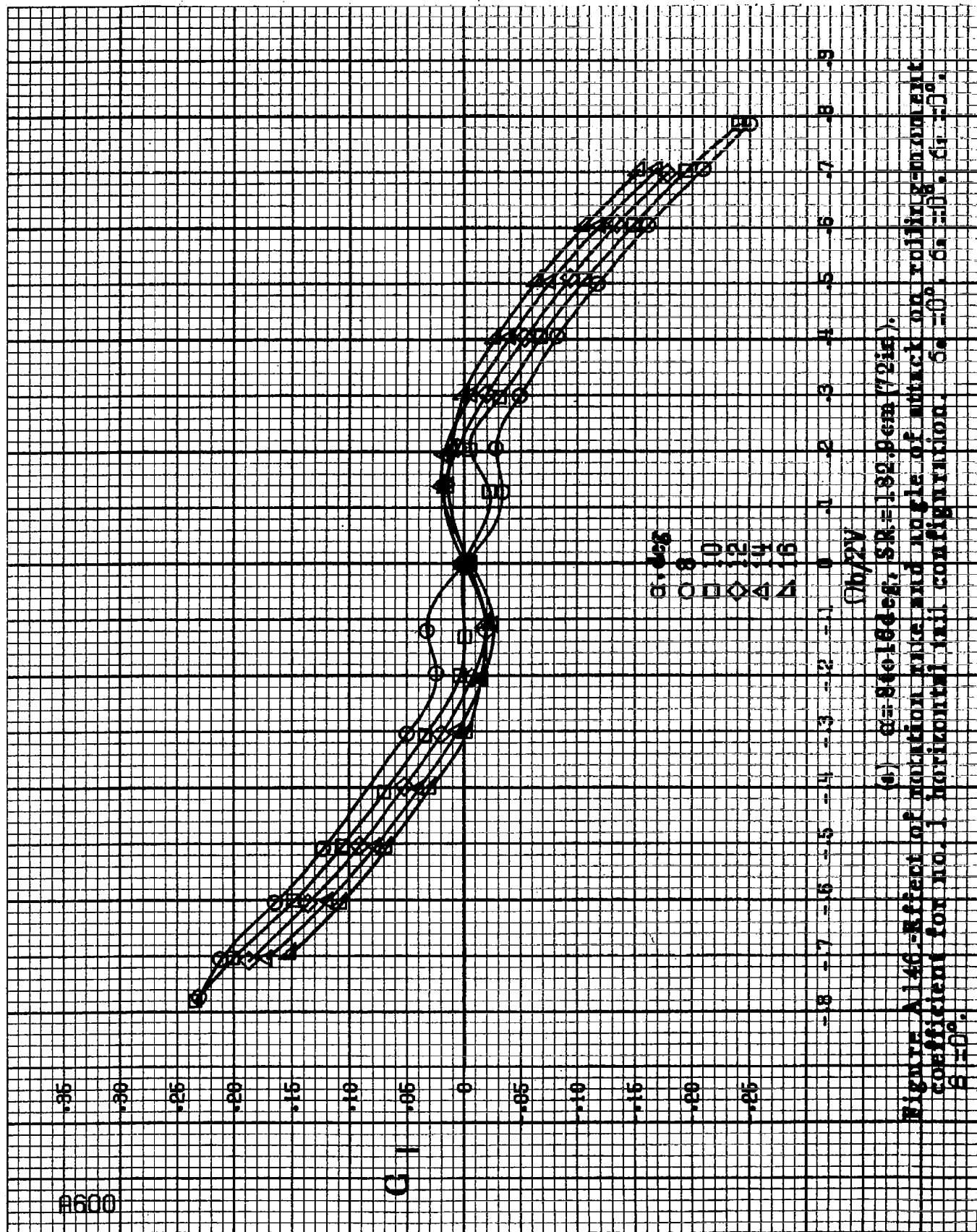
$\alpha, \text{deg}$   
 $\circ 30$   
 $\square 35$   
 $\diamond 40$   
 $\triangle 45$   
 $\nabla 50$



(c)  $\alpha=30$  to  $50^\circ$ ,  $SR=0$ .  
 Figure A145. Continued.

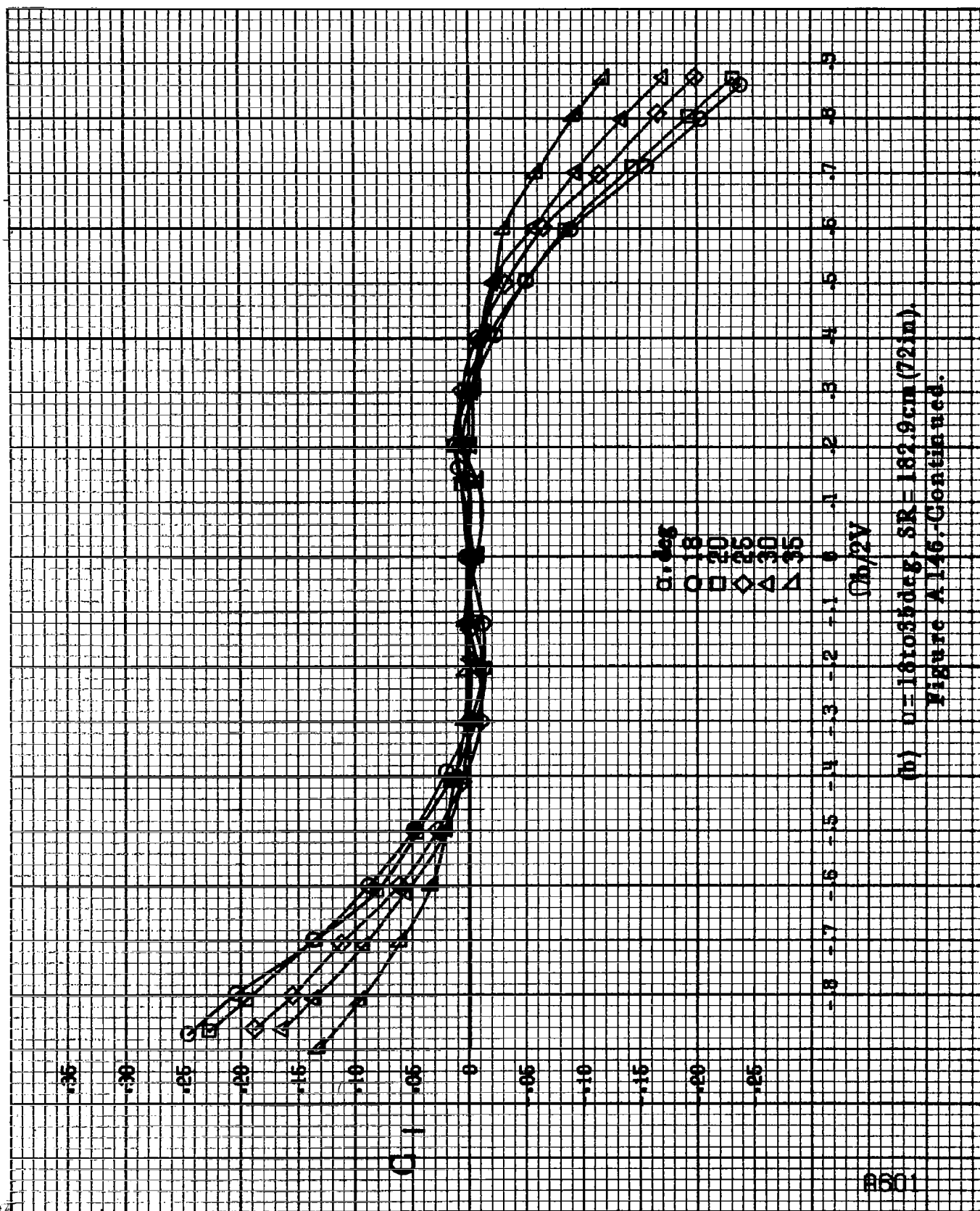


(d)  $\alpha=55$  to  $90^\circ$ ,  $SR=0$ .  
Figure A145. Concluded.



(a)  $\alpha = 84.18 \text{ deg}$ ,  $SR = 132.9 \text{ cm} (72 \text{ in})$ .

Figure A146 - Effect of rotation rate and angle of attack on coefficient of attack for no. 1 horizontal tail configuration.  $\delta = 0^\circ$ ,  $\delta = 6^\circ$ ,  $\delta = 10^\circ$ .



(b)  $\theta = 16$  to  $35$  deg,  $SR = 182.9$  cm (72 in).

Figure A146: Continued.

A602

.35

.30

.25

.20

.15

.10

.05

0

-.05

-.10

-.15

-.20

-.25

$C_1$

$\alpha, \text{deg}$

○ 30

□ 35

◇ 40

△ 45

▽ 50

$\Omega_0/2V$

-.8

-.7

-.6

-.5

-.4

-.3

-.2

-.1

0

.1

.2

.3

.4

.5

.6

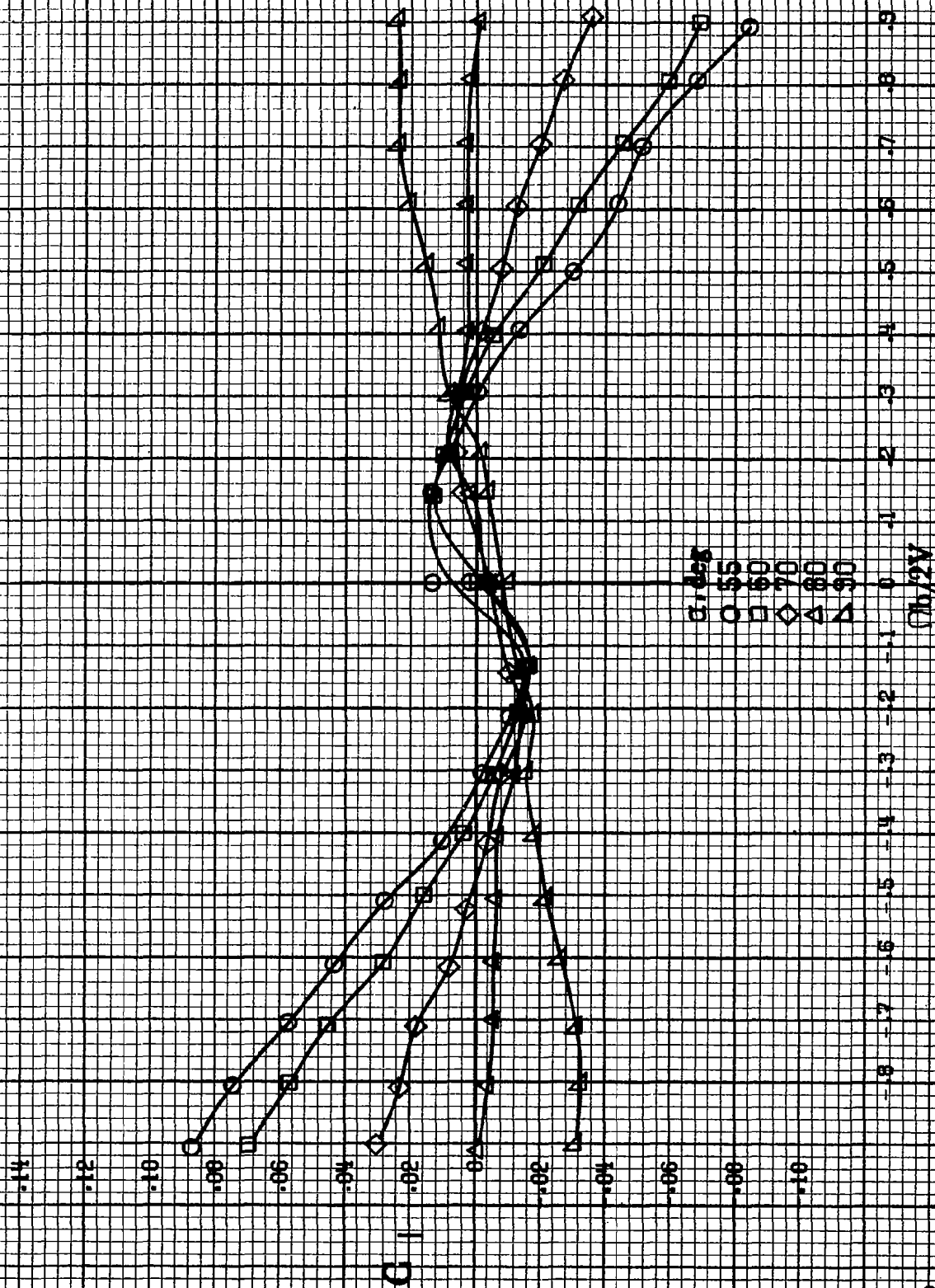
.7

.8

.9

(c)  $\Omega = 30$  to  $50 \text{ deg}$ ,  $SR = 0$ .

Figure A146-Continued.



(d)  $\alpha = 55^\circ$  to  $90^\circ$  deg,  $SR = 0$ .  
Figure A146, Continued.

8604

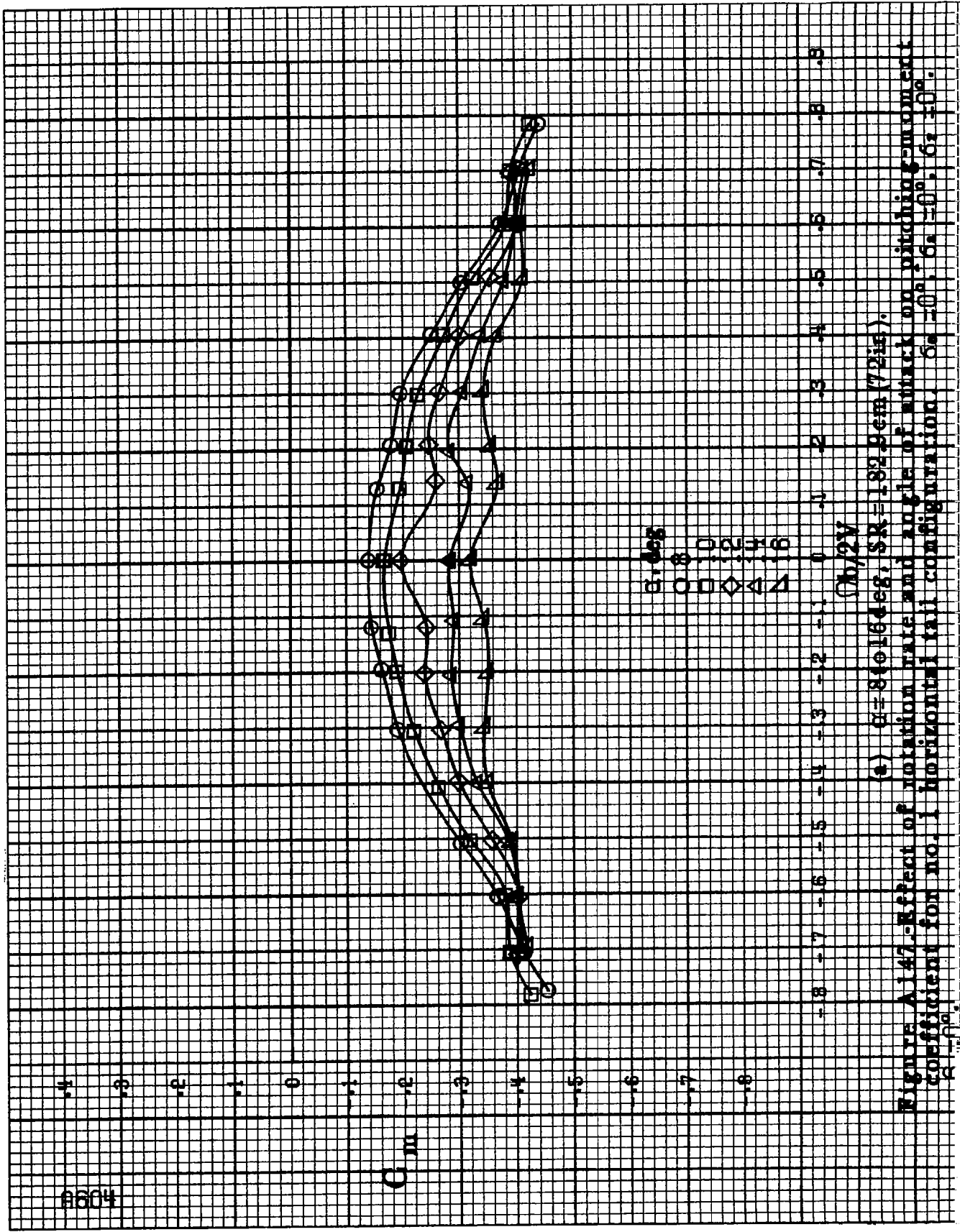
$C_m$

$\alpha, \text{deg}$

$M, 2V$

(a)  $\alpha = 8(\pm 0.16 \text{ deg})$ ,  $SR = 182.9 \text{ cm} (72 \text{ in})$ .

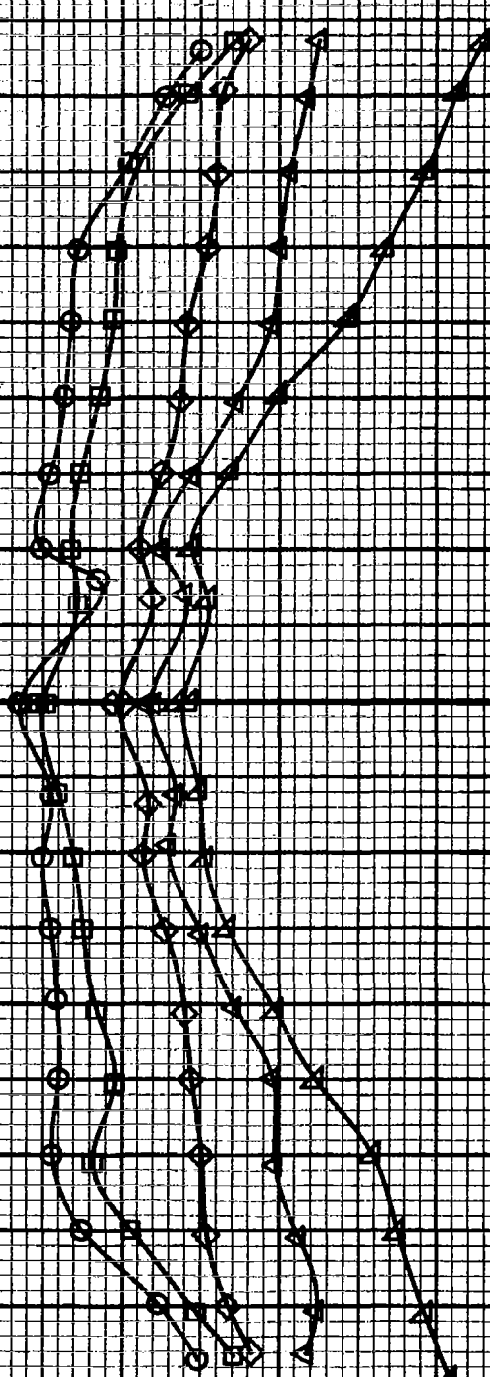
Figure A147. Effect of rotation rate and angle of attack on pitching moment coefficient for no. 1 horizontal tail configuration.  $\delta_a = 0^\circ$ ,  $\delta_r = 0^\circ$ ,  $\delta_s = 0^\circ$ .





0  
-.1  
-.2  
-.3  
-.4  
-.5  
-.6  
-.7  
-.8  
-.9  
-1.0  
-1.1  
-1.2

$C_m$



$\theta, \text{deg}$

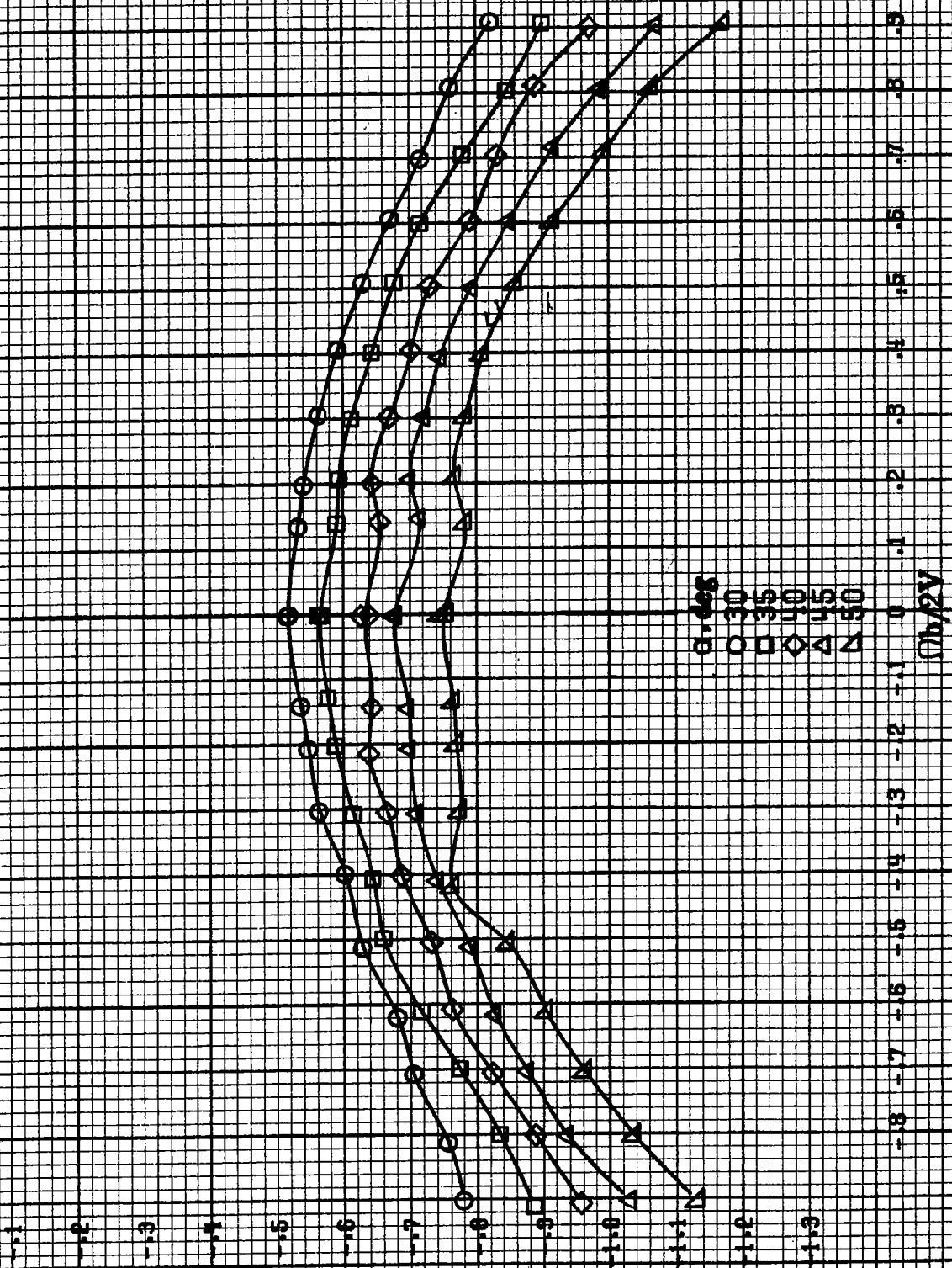
18  
20  
25  
30  
35

$V_{b/2V}$

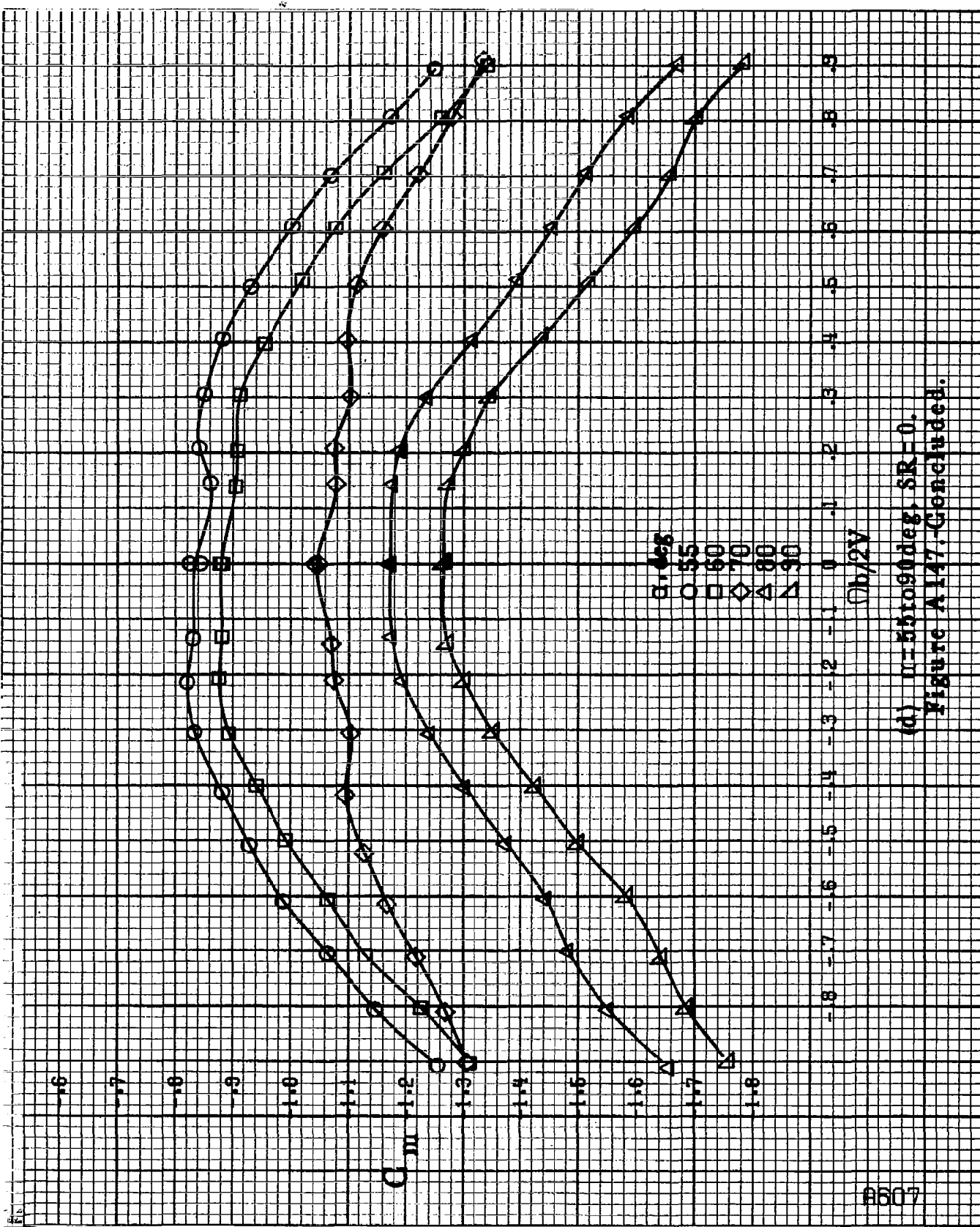
(b)  $\mu = 181055 \text{ deg}$ ,  $SR = 182.9 \text{ cm (72 in)}$ .  
Figure A147-Continued.

A606

$C_m$



(c)  $\phi = 86.060 \text{ deg}$ ,  $SR = 0$ .  
Figure A147, Continued.



(d)  $\alpha = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A147. Concluded.



$\alpha$ , deg  
 18  
 20  
 25  
 30  
 35

2.4

2.0

1.6

1.2

0.8

0.4

0.0

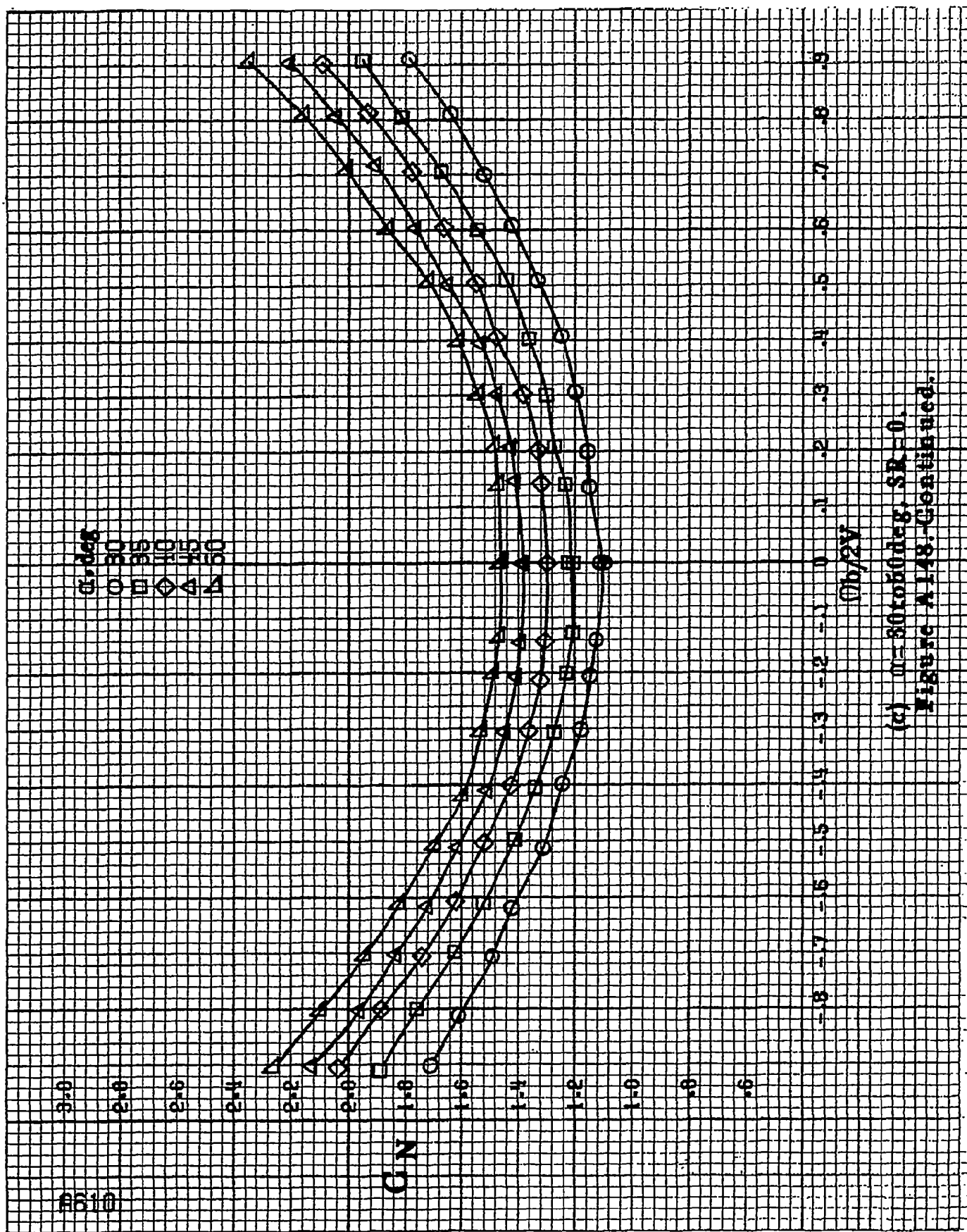
C/N

-1.8 -1.7 -1.6 -1.5 -1.4 -1.3 -1.2 -1.1 -1.0 -0.9 -0.8 -0.7 -0.6 -0.5 -0.4 -0.3 -0.2 -0.1 0 .1 .2 .3 .4 .5 .6 .7 .8 .9

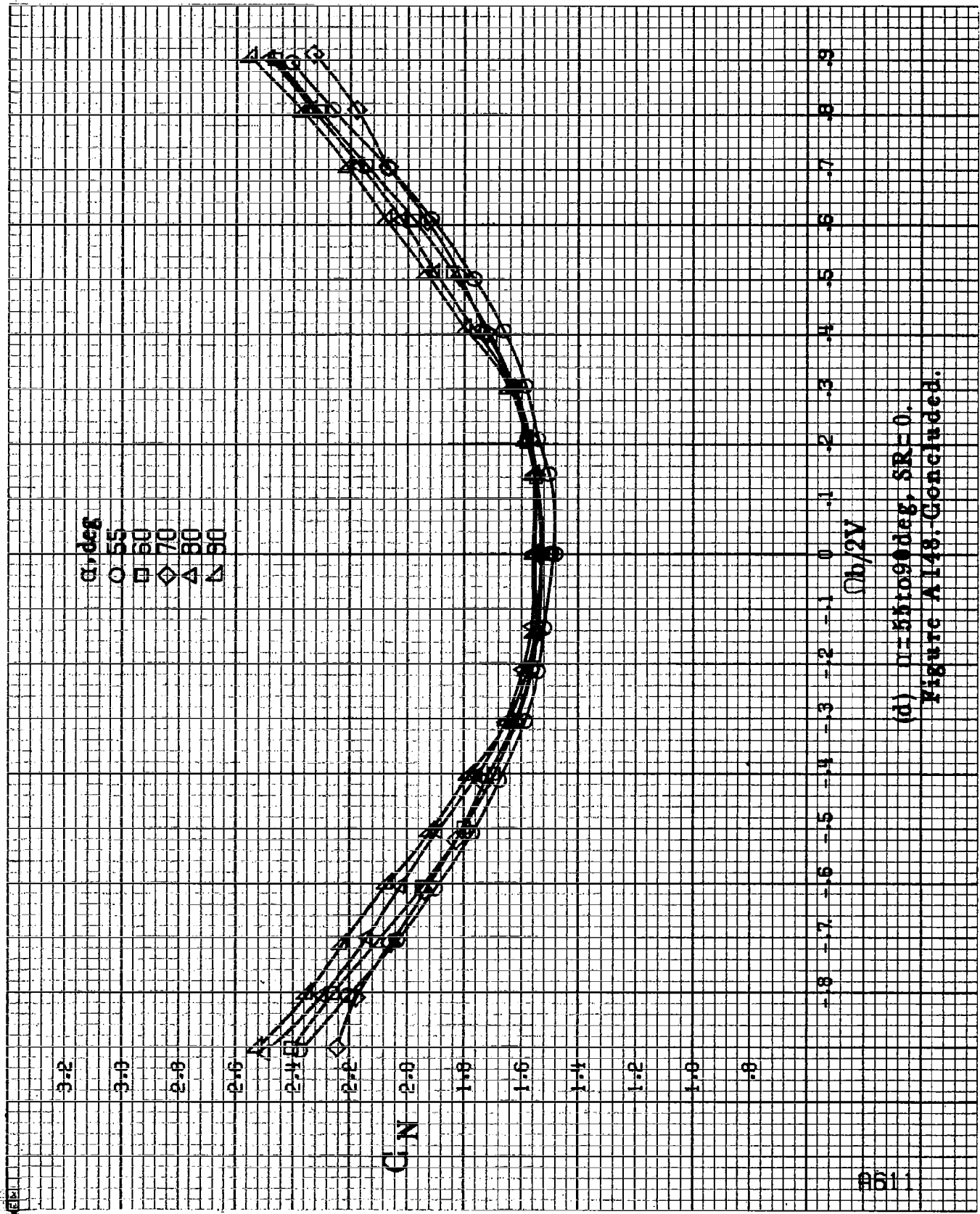
$\Omega_b/2\pi$

(b)  $\alpha=16$  to  $35$  deg, SR=182.9 cm (72 in.)  
 Figure A148-Continued.

8609



(a)  $\alpha = 30$  to  $50$  deg,  $SR = 0$ ,  
Figure A148-Continued.



(d)  $\Omega = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A148. Concluded.

8612

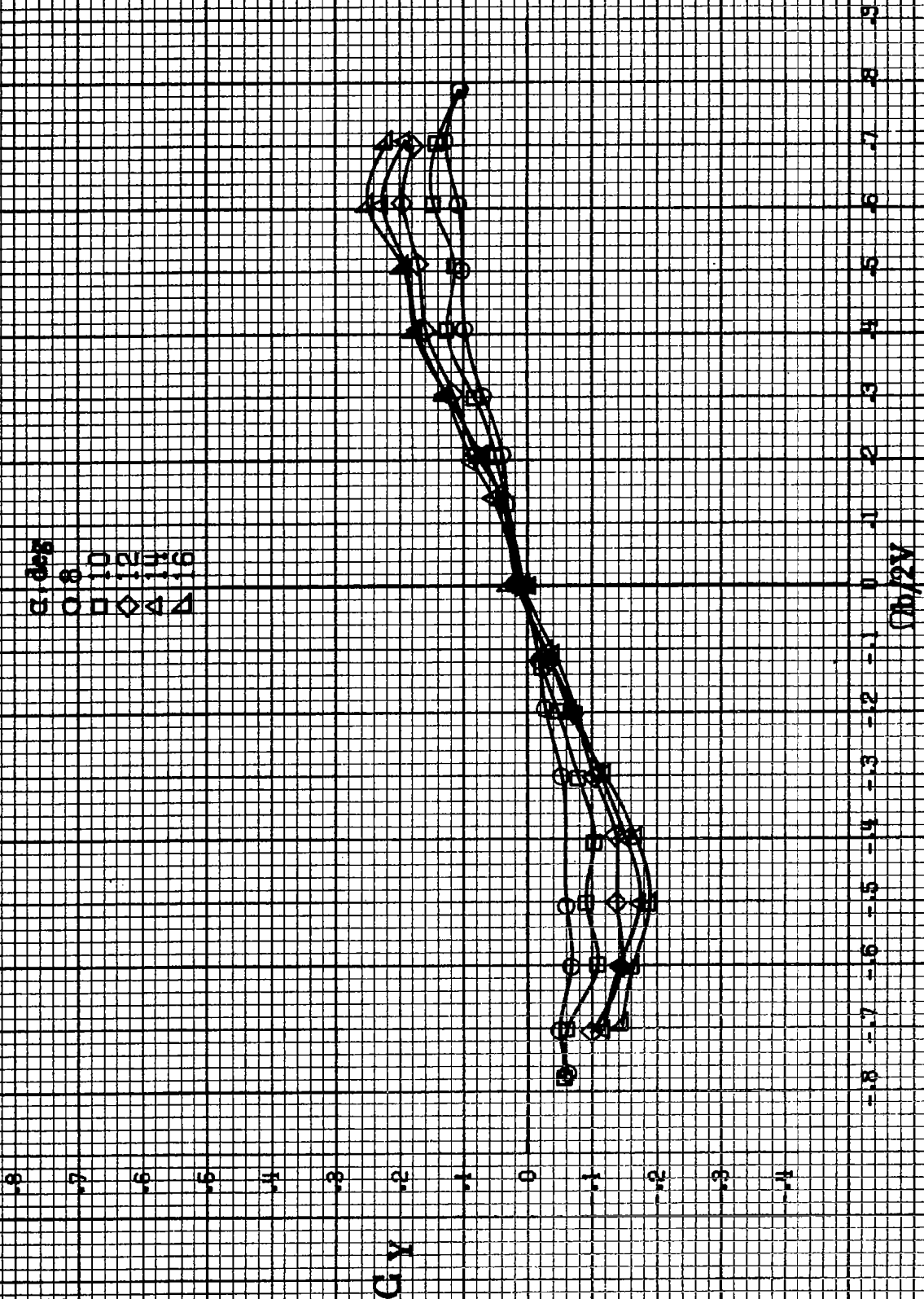
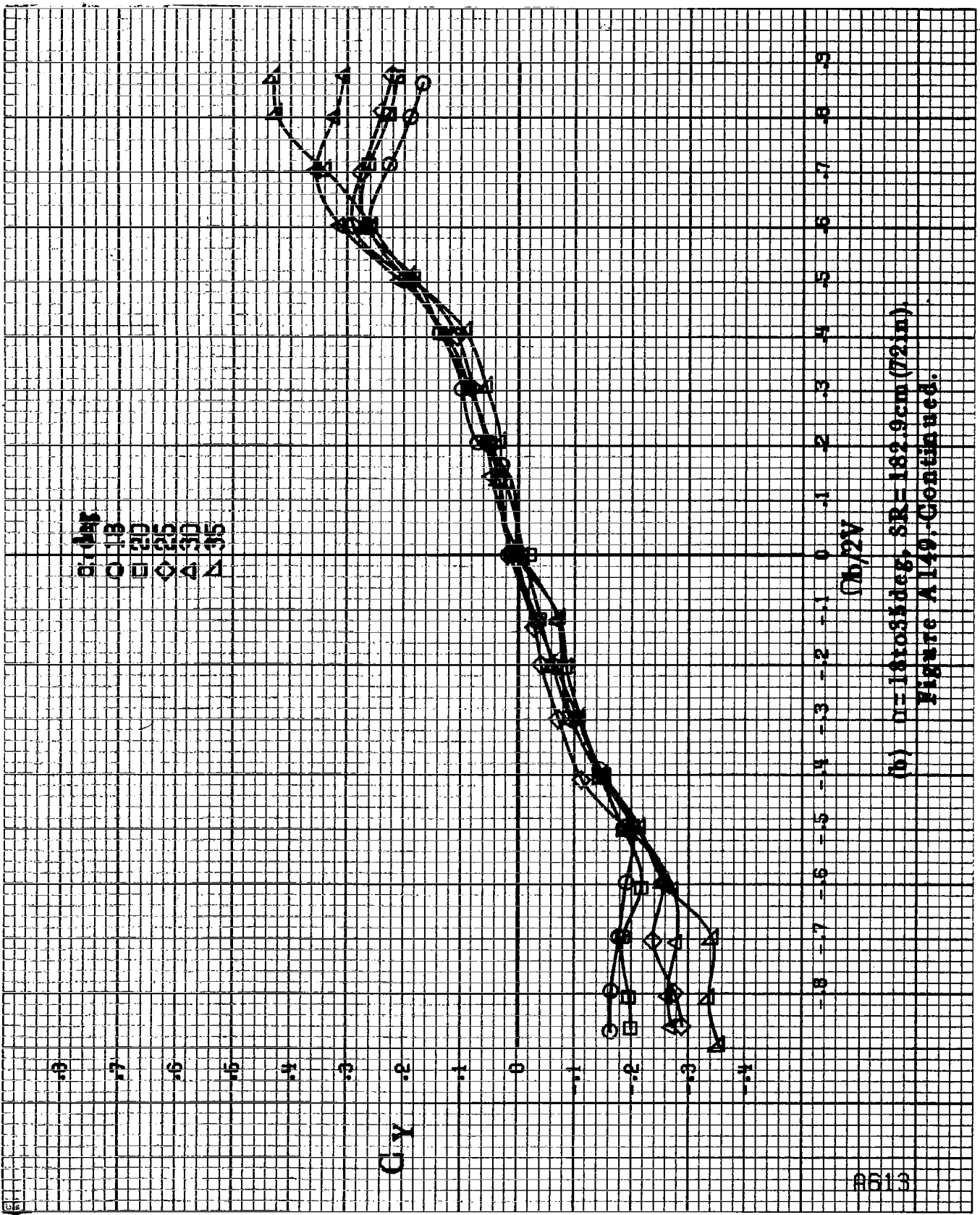


Figure A149.-Effect of rotation rate and angle of attack on side-force coefficient for no. 1 horizontal tail configuration.  $\delta_a = 0^\circ$ ,  $\delta_s = 0^\circ$ ,  $\delta_r = 0^\circ$ .





(b)  $\alpha = 18$  to  $35$  deg,  $SR = 182.9$  cm (72 in).  
Figure A149, Continued.

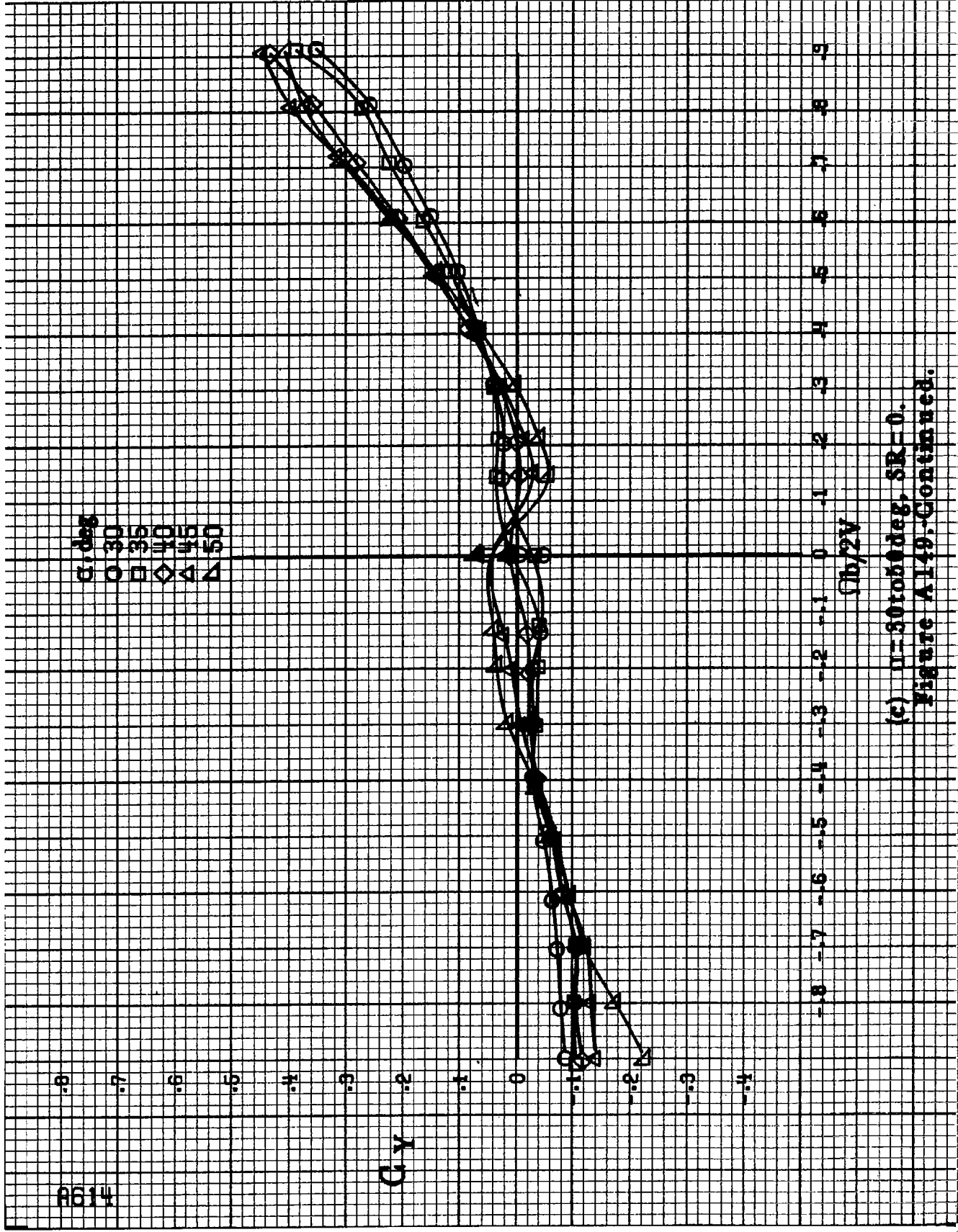
A614

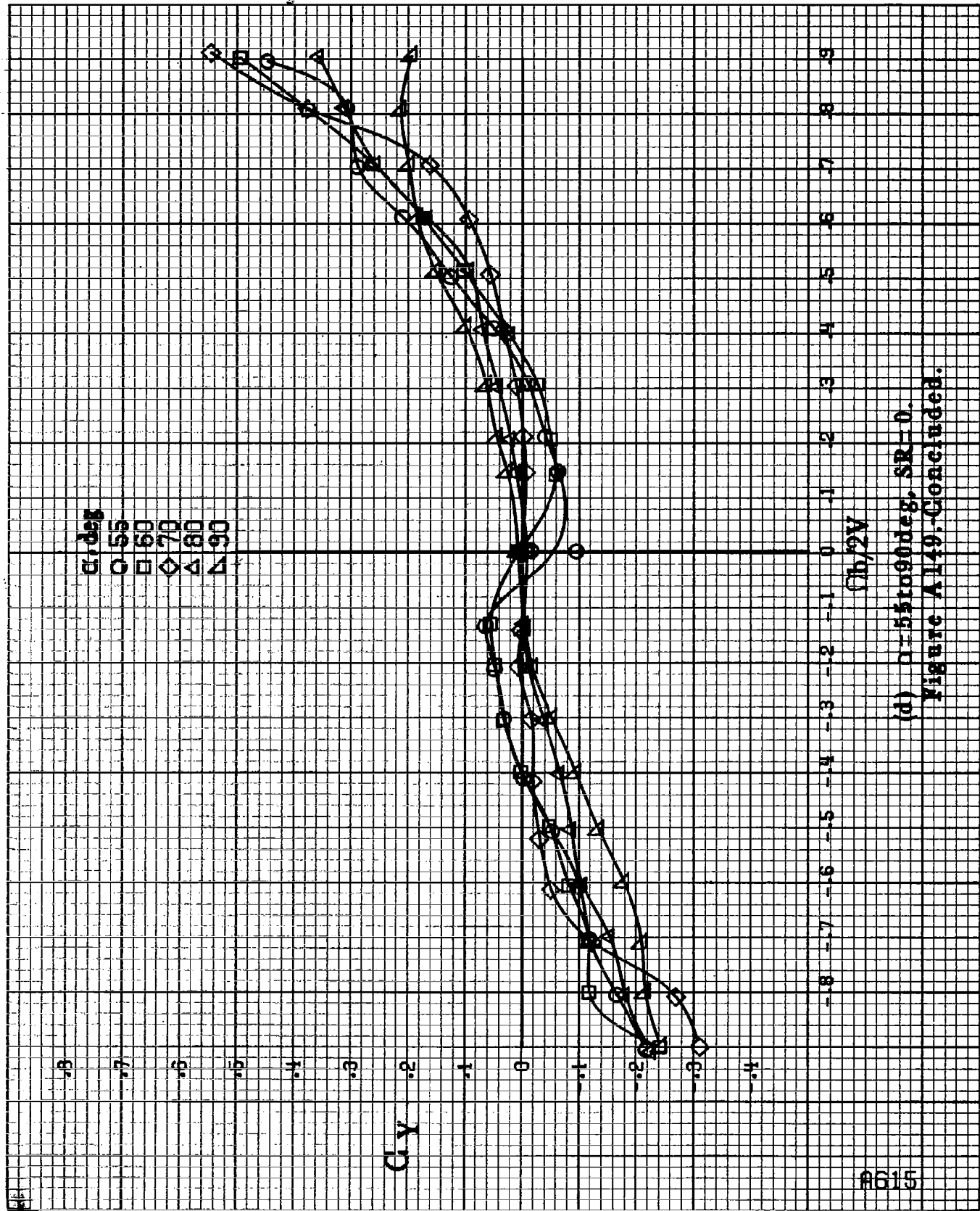
$\alpha$ , deg  
 O 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▽ 50

$C_V$

$\Omega b/2V$

(c)  $\Omega = 30 \text{ to } 50 \text{ deg}$ ,  $\delta R = 0$ .  
 Figure A149. Continued.





(d)  $\alpha=55$  to  $90^\circ$ ,  $SR=0$ .  
Figure A149-Concluded.

#616

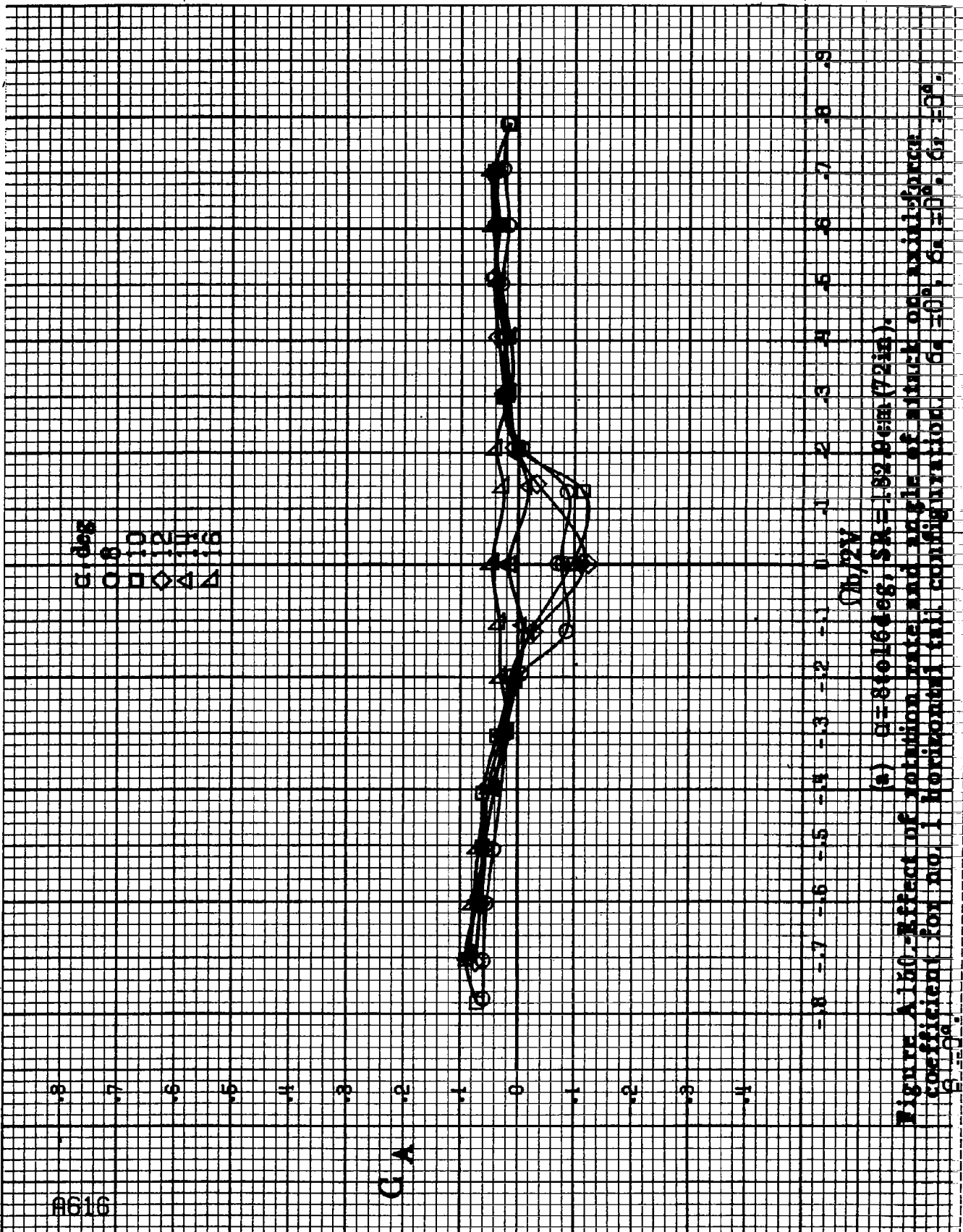
$\alpha, \text{deg}$   
 $\circ 0$   
 $\square 1$   
 $\diamond 2$   
 $\triangle 3$   
 $\nabla 4$   
 $\blacktriangle 5$

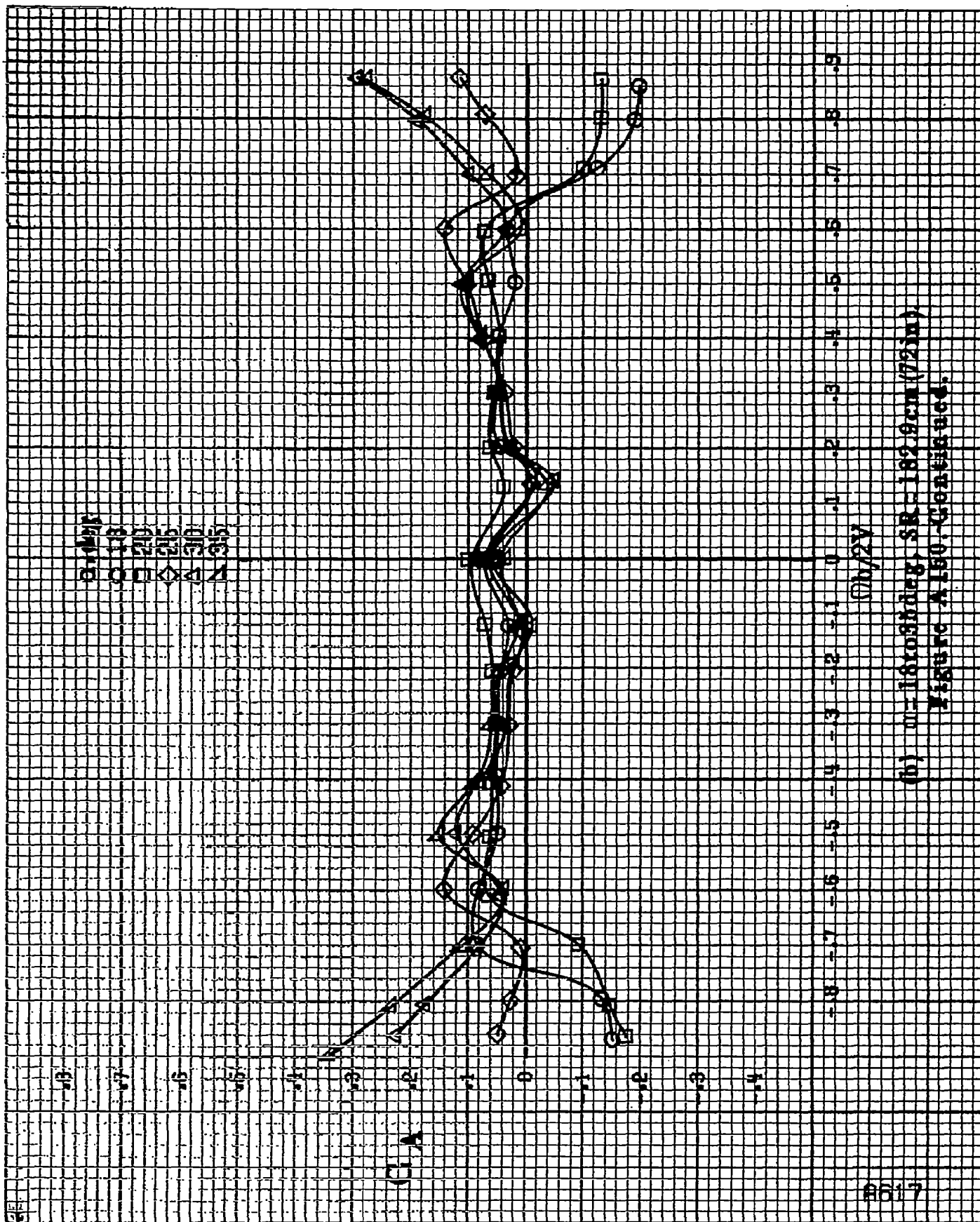
$C_A$

$\Omega, \text{rpm}$

(a)  $\alpha = 8$  to  $16$  deg,  $SR = 1.82$  cm (72 in).

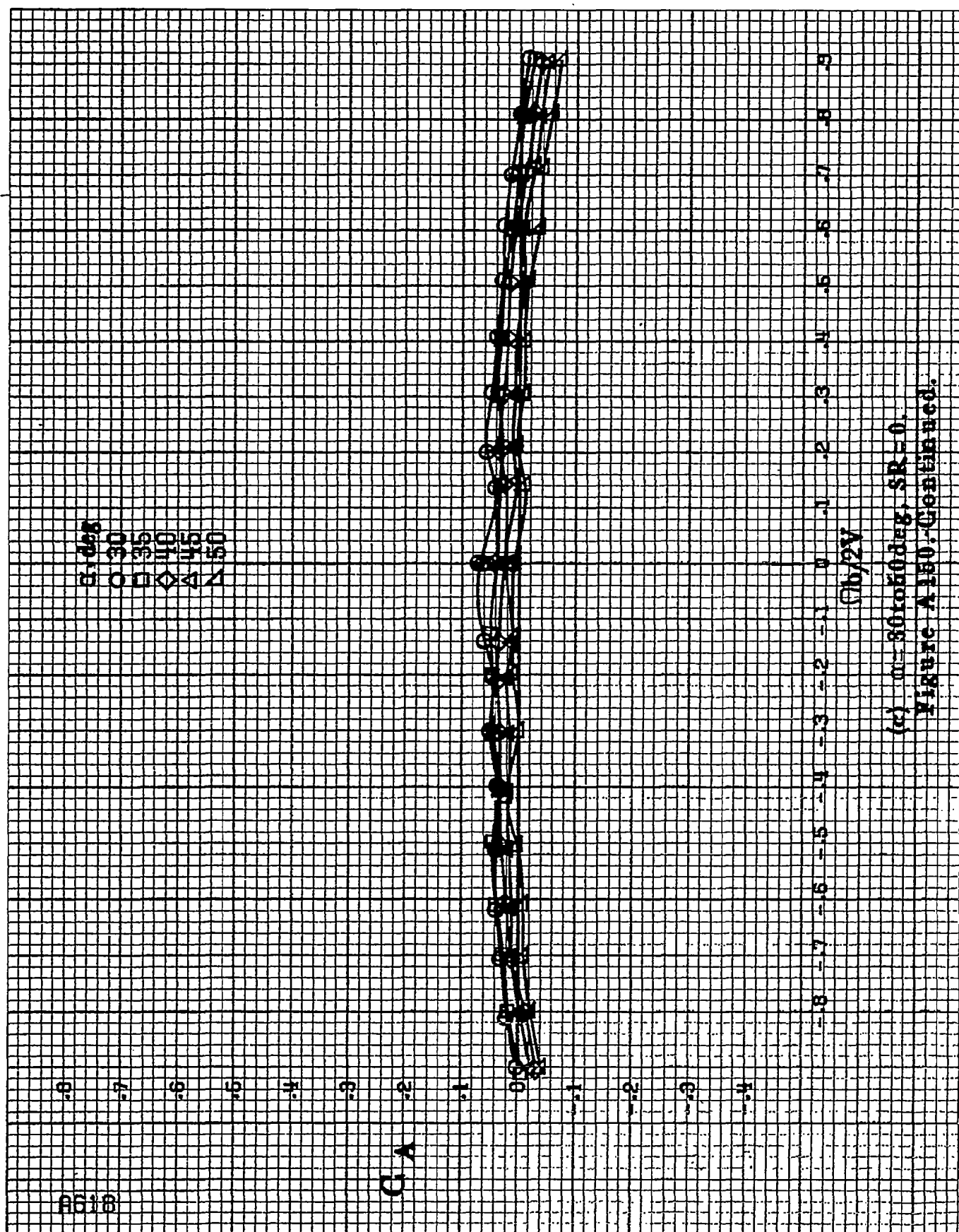
Figure A150.-Effect of rotation rate and angle of attack on axial force coefficient for no. 1 horizontal tail configuration.  $\delta_a = 0^\circ$ ,  $\delta_e = 0^\circ$ ,  $\delta_f = 0^\circ$ .



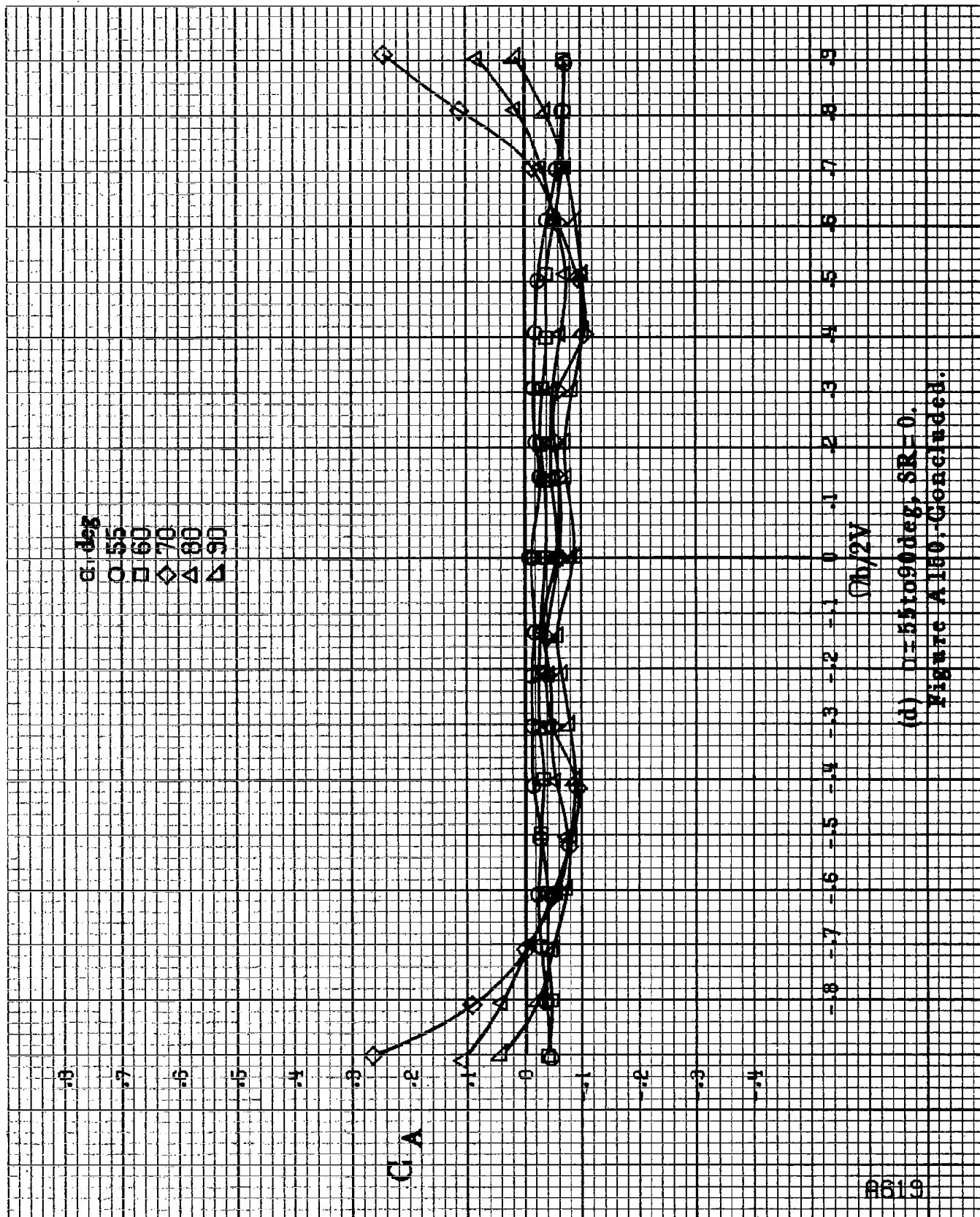


(b)  $m = 118.03 \text{ deg}$ ,  $SR = 182.9 \text{ cm (72 in)}$ .

Figure A-150. Continued.



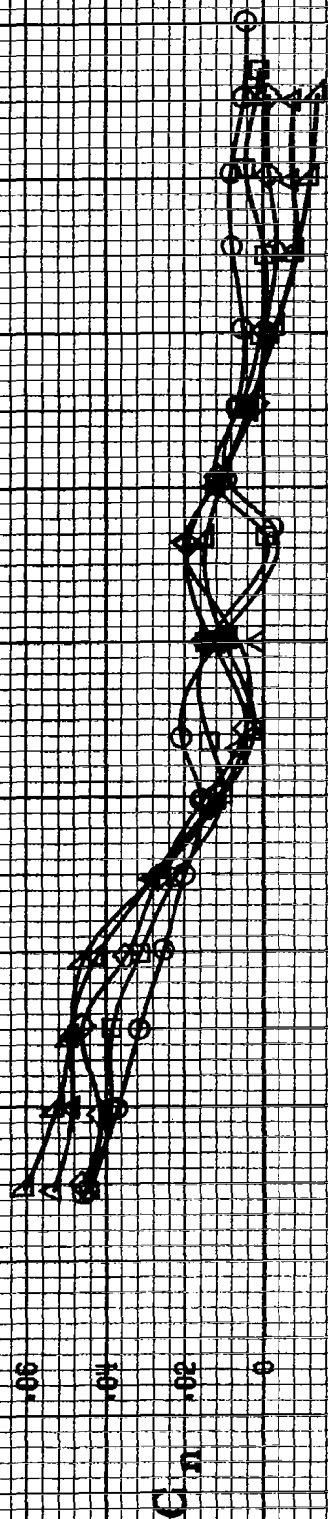
(c)  $\theta = 30$  to  $50$  deg,  $SR = 0$ .  
Figure A150-Continued.



(d)  $\alpha = 55$  to  $90$  deg,  $SR = 0$ .  
Figure A180. Continued.

8620

$\alpha, \text{deg}$   
 8  
 10  
 12  
 14  
 16

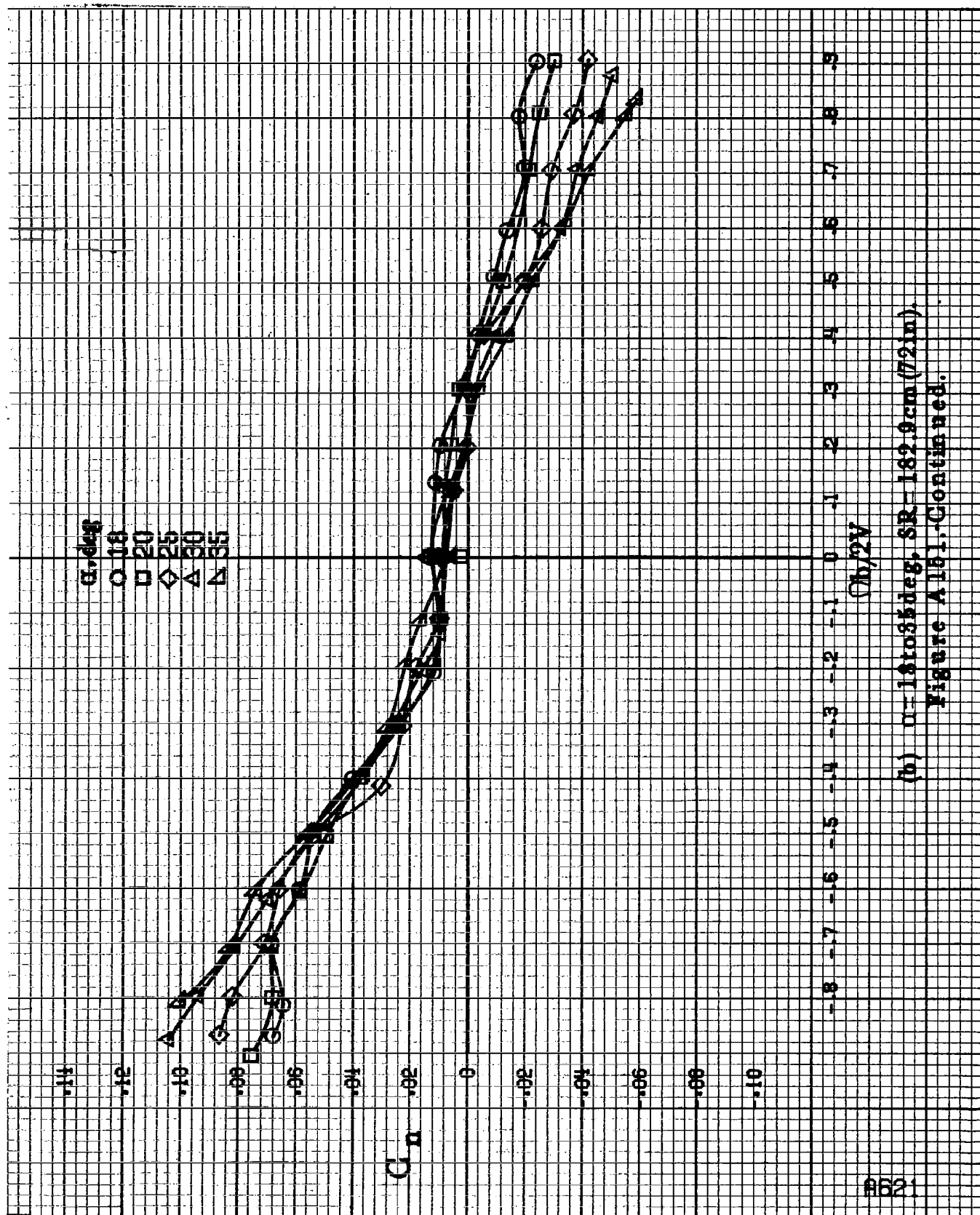


$Ob/2V$

(a)  $\alpha = 8$  to  $16 \text{ deg}$ ,  $SR = 182.9 \text{ cm (72 in)}$ .

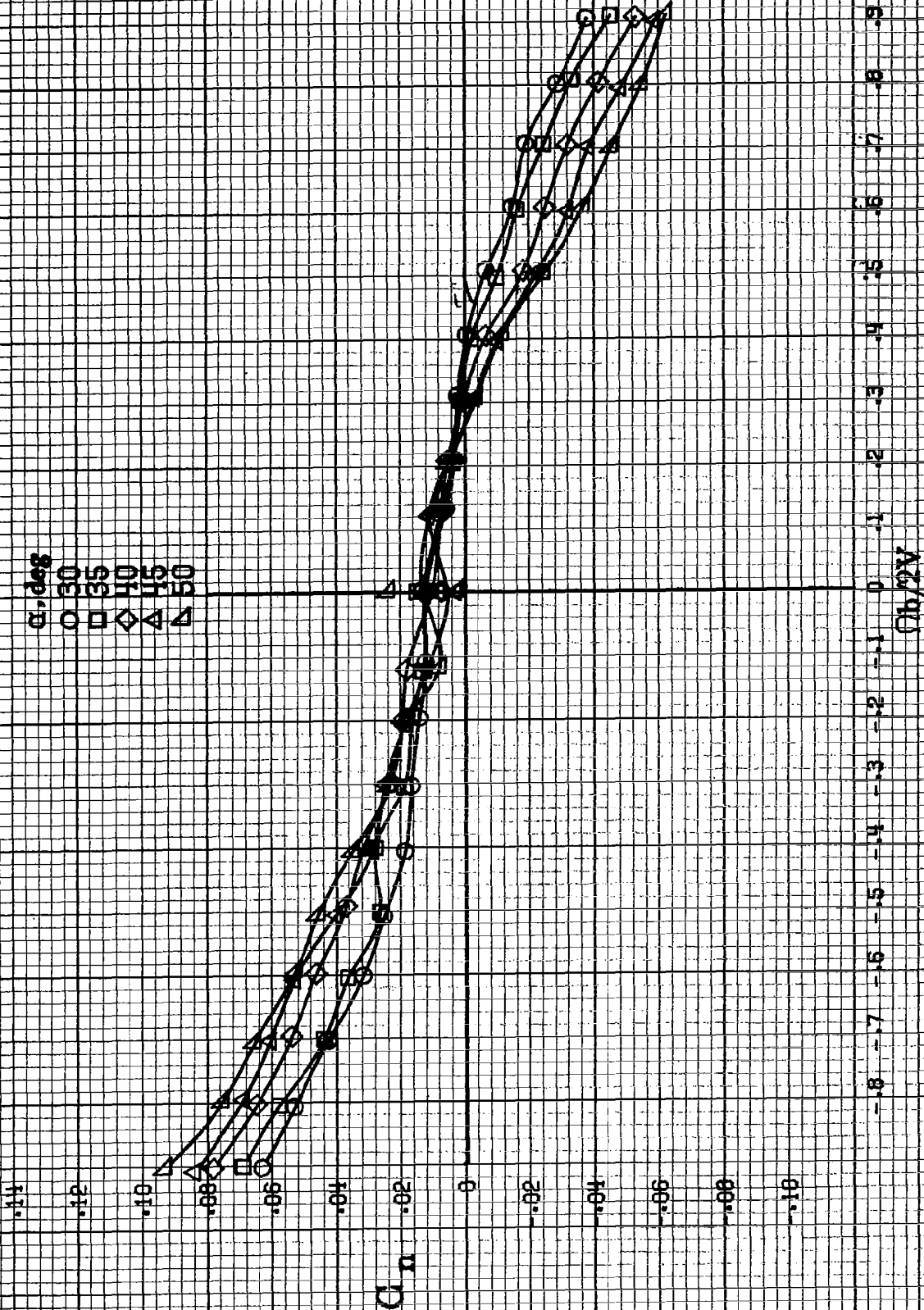
Figure A141.-Effect of notation rate and angle of attack on yawing moment coefficient for no. 1 horizontal tail configuration.  $\delta_e = -15^\circ$ ,  $\delta_a = 0^\circ$ ,  $\delta_r = -25^\circ$ ,  $\delta = 0^\circ$ .



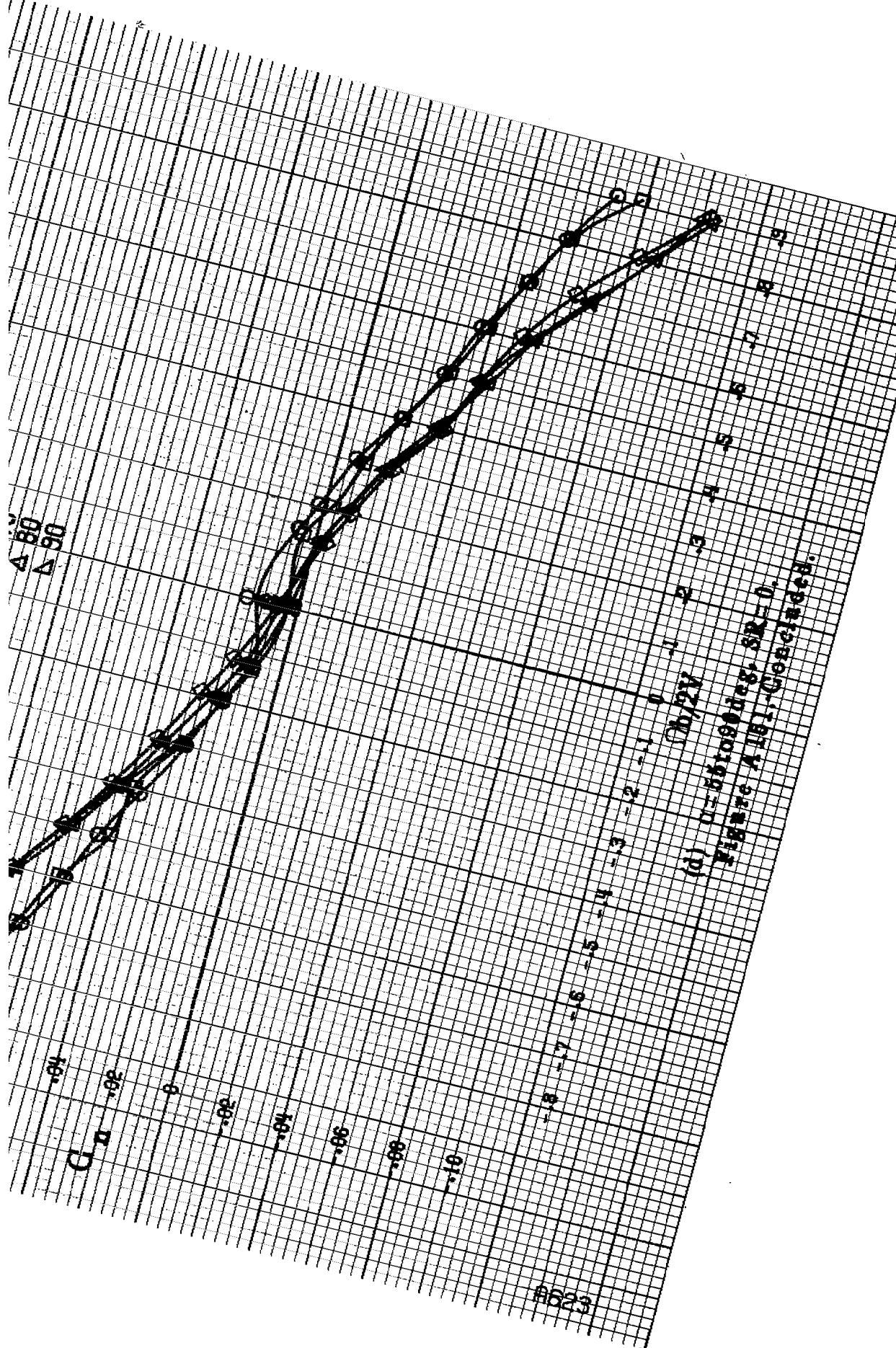


(b)  $\alpha = 18$  to  $55 \text{ deg}$ ,  $SR = 162.9 \text{ cm (72 in)}$ .  
Figure A161.-Continued.

A622



(c)  $\alpha=30$  to  $50^\circ$ ,  $SR=0$ .  
Figure A1b1-Continued.



(d)  $0.55 \times 10^9$  sec,  $SR = 0$ .  
Figure A161, Continued.

8624

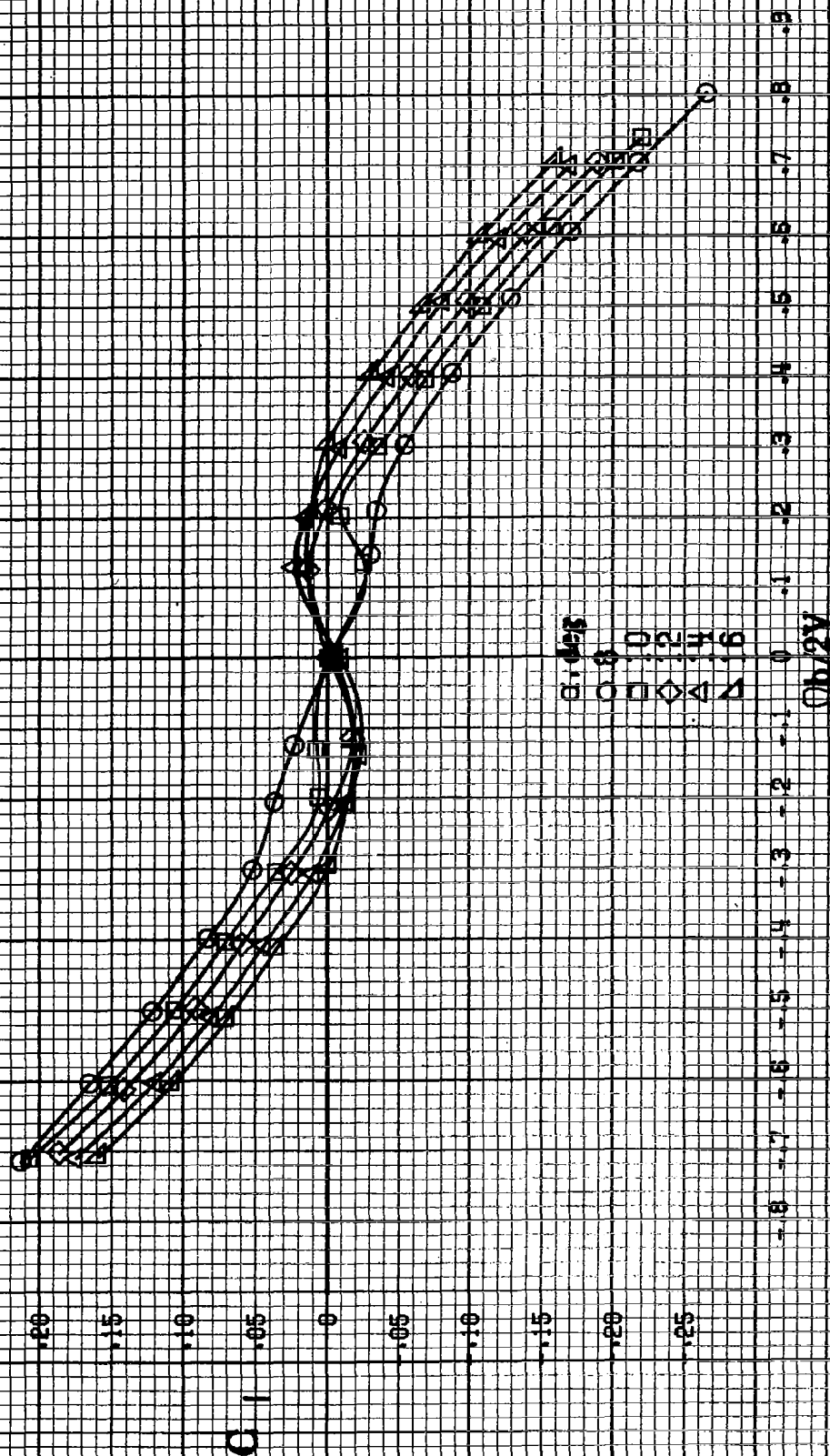
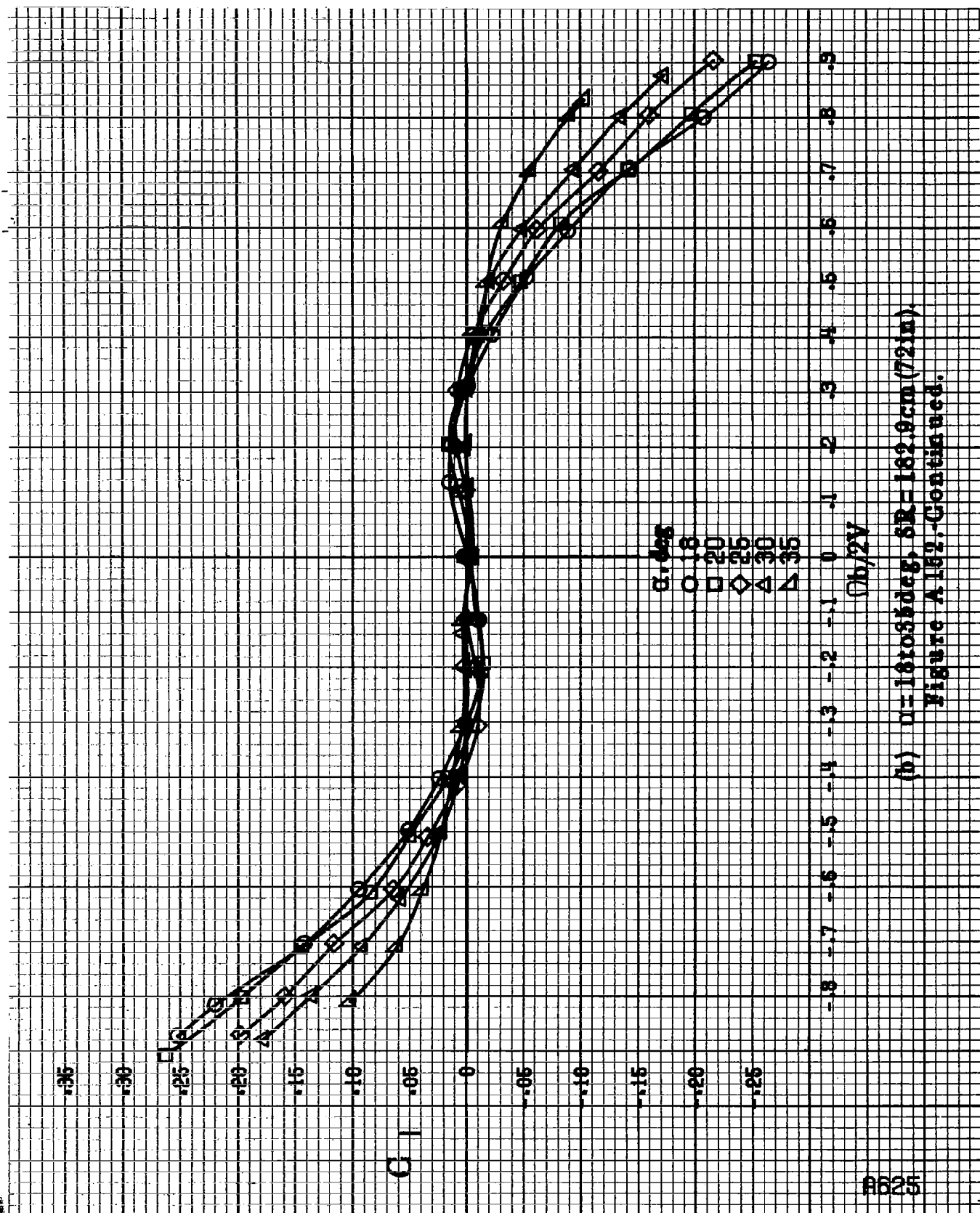
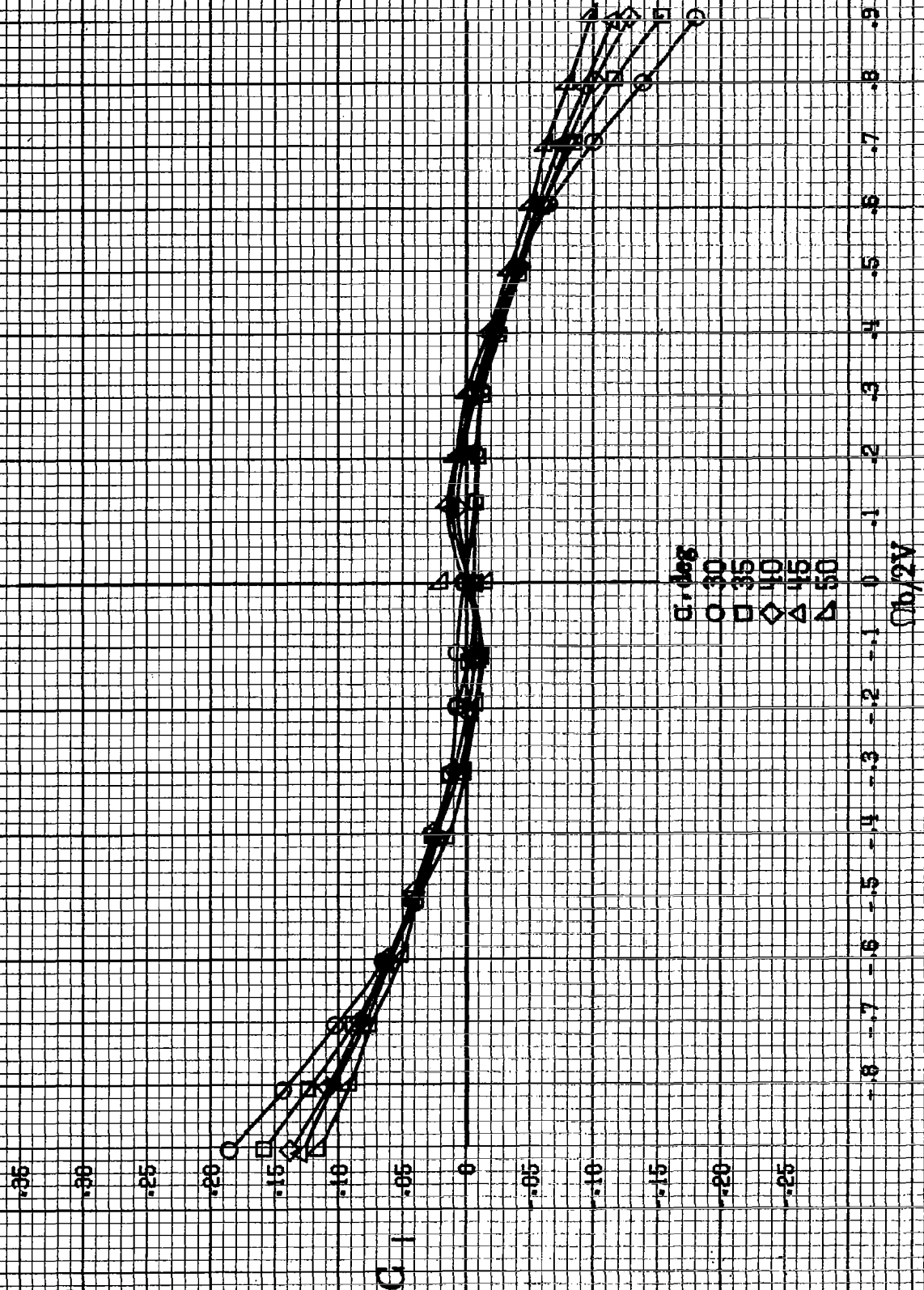


Figure A162. Effect of rotation rate and angle of attack on rolling moment coefficient for no. 1 horizontal tail configuration.  $\delta_a = -15^\circ$ ,  $\delta_s = -25^\circ$ ,  $\delta_r = 0^\circ$ .

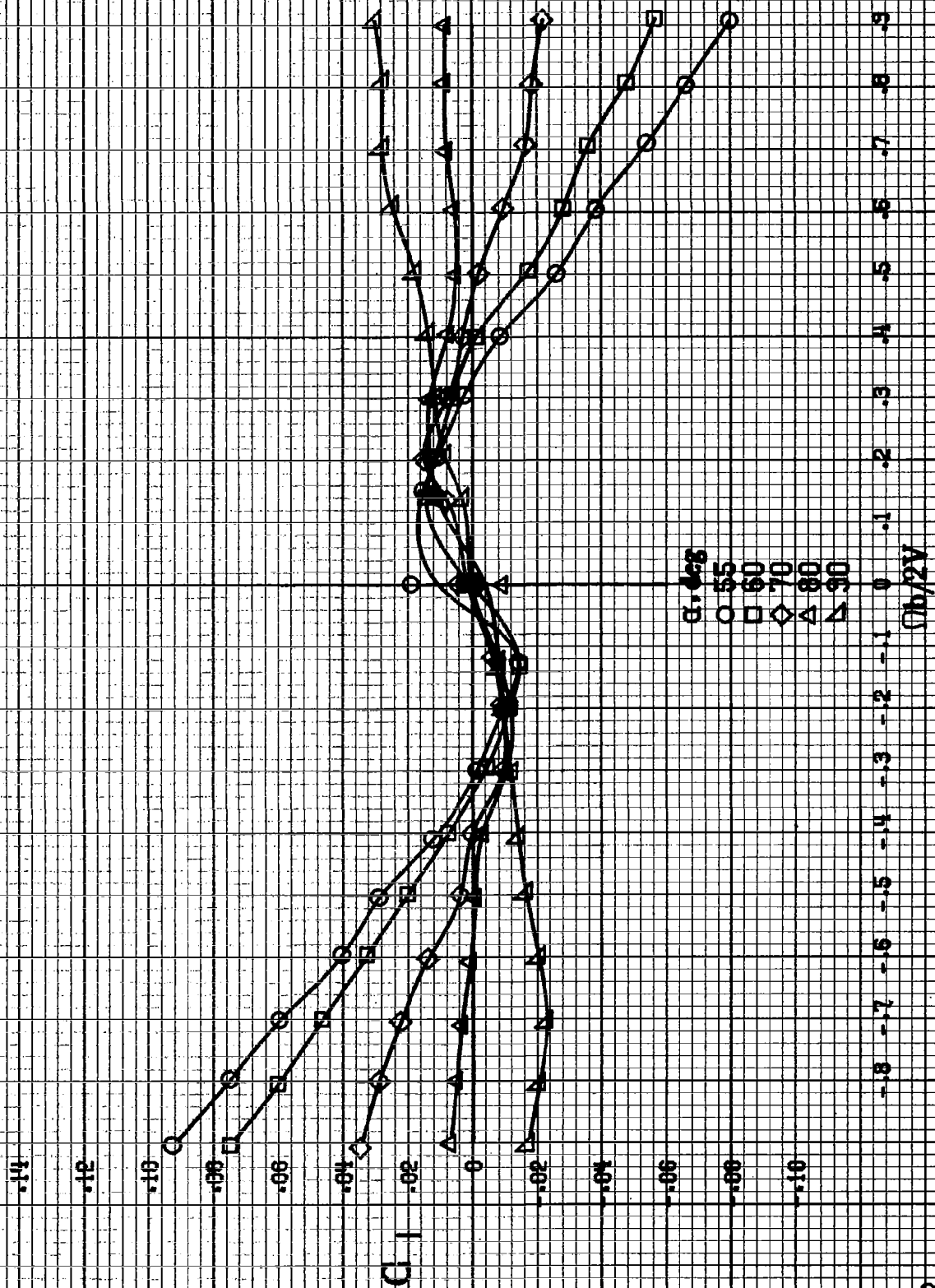


(b)  $\mu = 1610.8 \text{ kg/cm}^2$ ,  $SR = 182.9 \text{ cm} (72 \text{ in})$ .  
Figure A152-Continued.

A626



(c)  $\alpha=30$  to  $50^\circ$ ,  $SR=0$ .  
Figure A162. Continued.



(d)  $\alpha = 85$  to  $90$  deg,  $\delta R = 0$ .  
Figure A152.-Concluded.

B326

C<sub>m</sub>

α, deg

○ 8  
□ 10  
◇ 12  
△ 14  
▽ 16

Ch/2V

(a)  $\alpha = 8$  to  $16$  deg,  $SR = 132.9 \text{ cm} (21\text{in})$ .

Figure A158. Effect of rotation rate and angle of attack on pitching moment coefficient for no. 1 horizontal tail configuration.  $\delta_a = 15^\circ$ ,  $\delta_e = 25^\circ$ ,  $\delta_r = 0^\circ$ .

B-1



14

13

12

11

10

$C_m$

9

8

7

6

5

4

3

2

1

0

-1

-2

-3

-4

-5

-6

-7

-8

-9

-10

-11

-12

-13

-14

-15

-16

-17

-18

-19

-20

-21

-22

-23

-24

-25

-26

-27

-28

-29

-30

-31

-32

-33

-34

-35

-36

-37

-38

-39

-40

-41

-42

-43

-44

-45

-46

-47

-48

-49

-50

-51

-52

-53

-54

-55

-56

-57

-58

-59

-60

-61

-62

-63

-64

-65

-66

-67

-68

-69

-70

-71

-72

-73

-74

-75

-76

-77

-78

-79

-80

-81

-82

-83

-84

-85

-86

-87

-88

-89

-90

-91

-92

-93

-94

-95

-96

-97

-98

-99

-100

-101

-102

-103

-104

-105

-106

-107

-108

-109

-110

-111

-112

-113

-114

-115

-116

-117

-118

-119

-120

-121

-122

-123

-124

-125

-126

-127

-128

-129

-130

-131

-132

-133

-134

-135

-136

-137

-138

-139

-140

-141

-142

-143

-144

-145

-146

-147

-148

-149

-150

-151

-152

-153

-154

-155

-156

-157

-158

-159

-160

-161

-162

-163

-164

-165

-166

-167

-168

-169

-170

-171

-172

-173

-174

-175

-176

-177

-178

-179

-180

-181

-182

-183

-184

-185

-186

-187

-188

-189

-190

-191

-192

-193

-194

-195

-196

-197

-198

-199

-200

-201

-202

-203

-204

-205

-206

-207

-208

-209

-210

-211

-212

-213

-214

-215

-216

-217

-218

-219

-220

-221

-222

-223

-224

-225

-226

-227

-228

-229

-230

-231

-232

-233

-234

-235

-236

-237

-238

-239

-240

-241

-242

-243

-244

-245

-246

-247

-248

-249

-250

-251

-252

-253

-254

-255

-256

-257

-258

-259

-260

-261

-262

-263

-264

-265

-266

-267

-268

-269

-270

-271

-272

-273

-274

-275

-276

-277

-278

-279

-280

-281

-282

-283

-284

-285

-286

-287

-288

-289

-290

-291

-292

-293

-294

-295

-296

-297

-298

-299

-300

-301

-302

-303

-304

-305

-306

-307

-308

-309

-310

-311

-312

-313

-314

-315

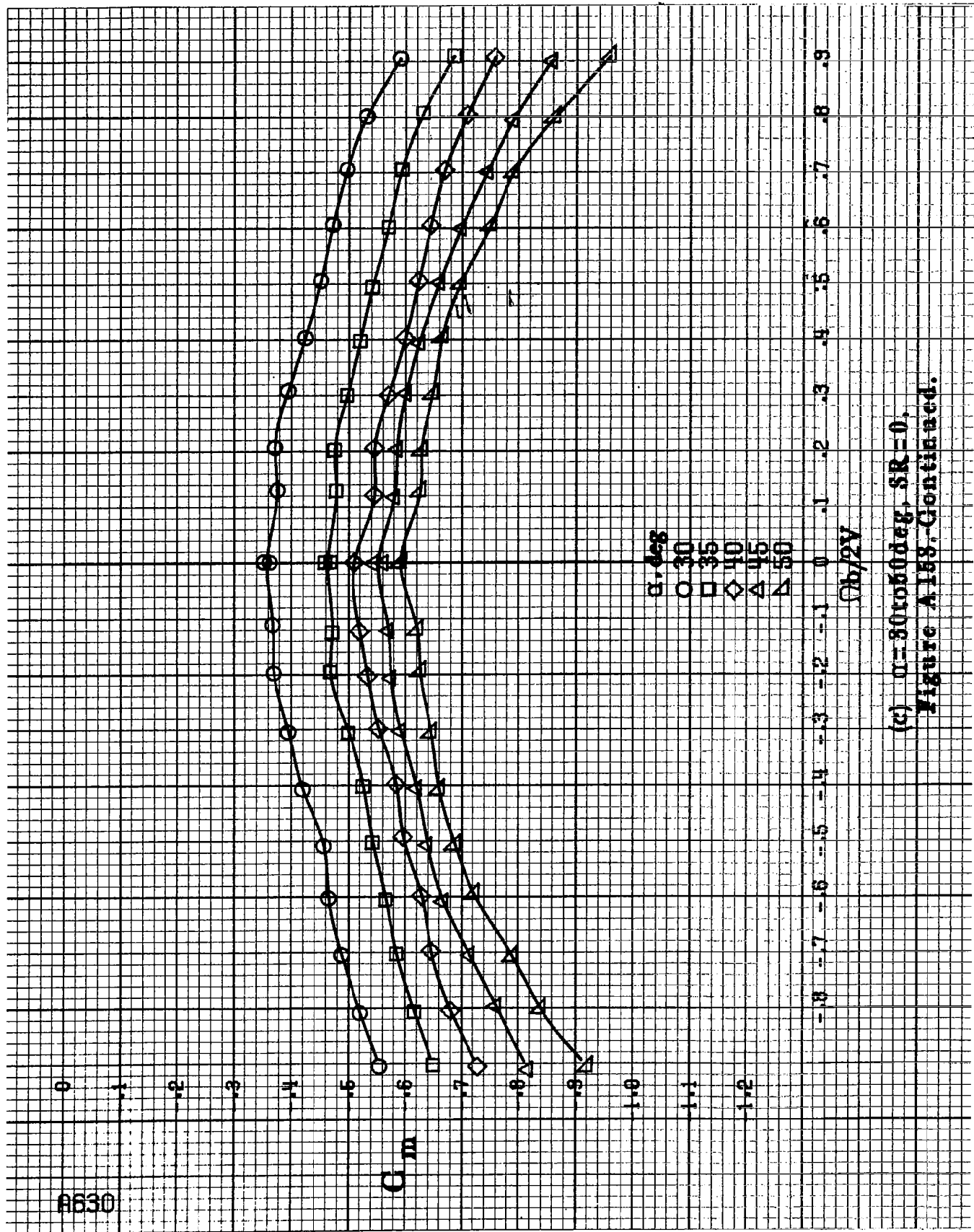
-316

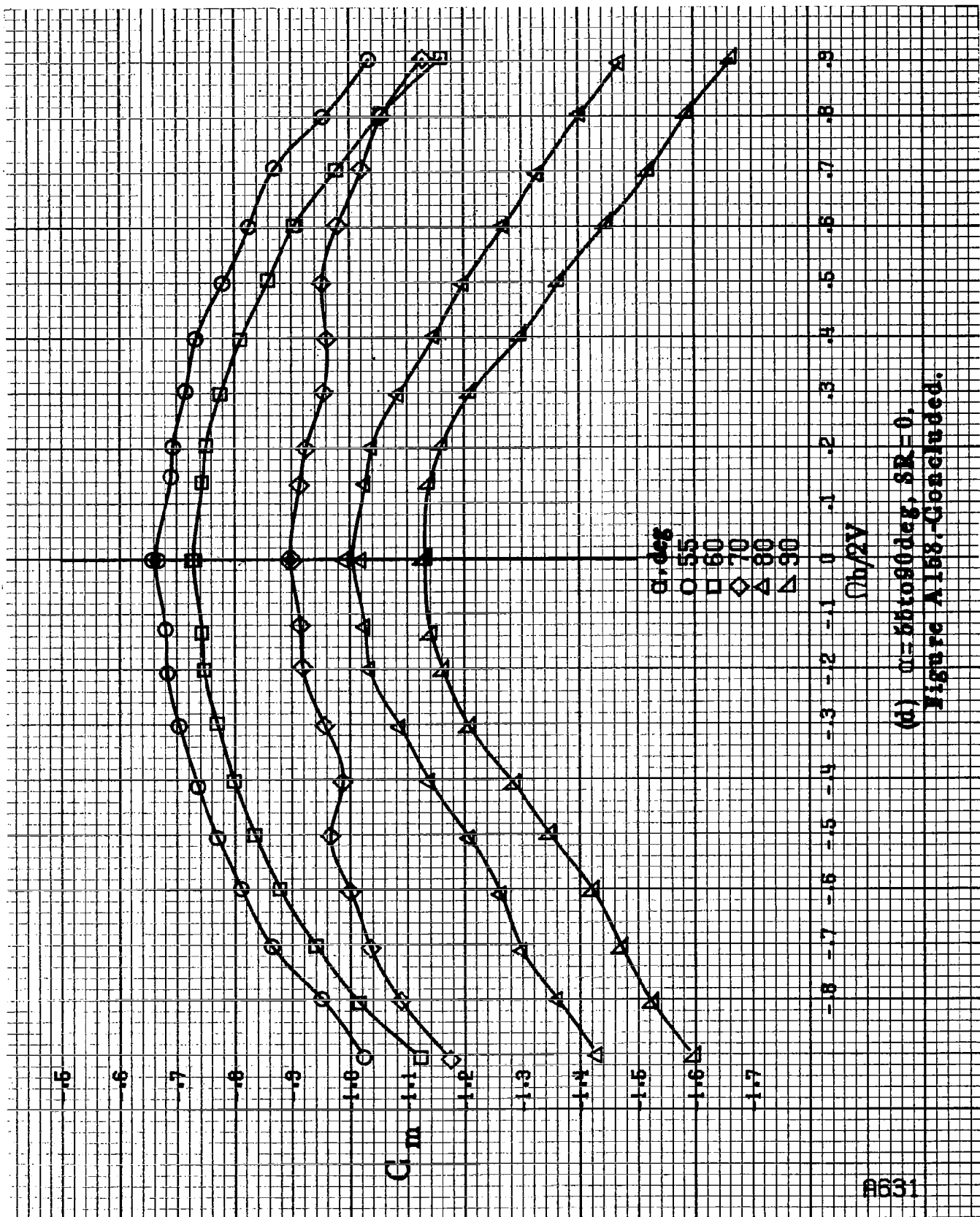
A630

$C_m$

$\alpha, \text{deg}$   
 ○ 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▲ 50  
 $\phi_b/2V$

(c)  $\alpha = 30$  to  $60$  deg,  $SR = 0$ ,  
 Figure A158, Continued.





(d)  $\alpha = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A158. Concluded.

8632

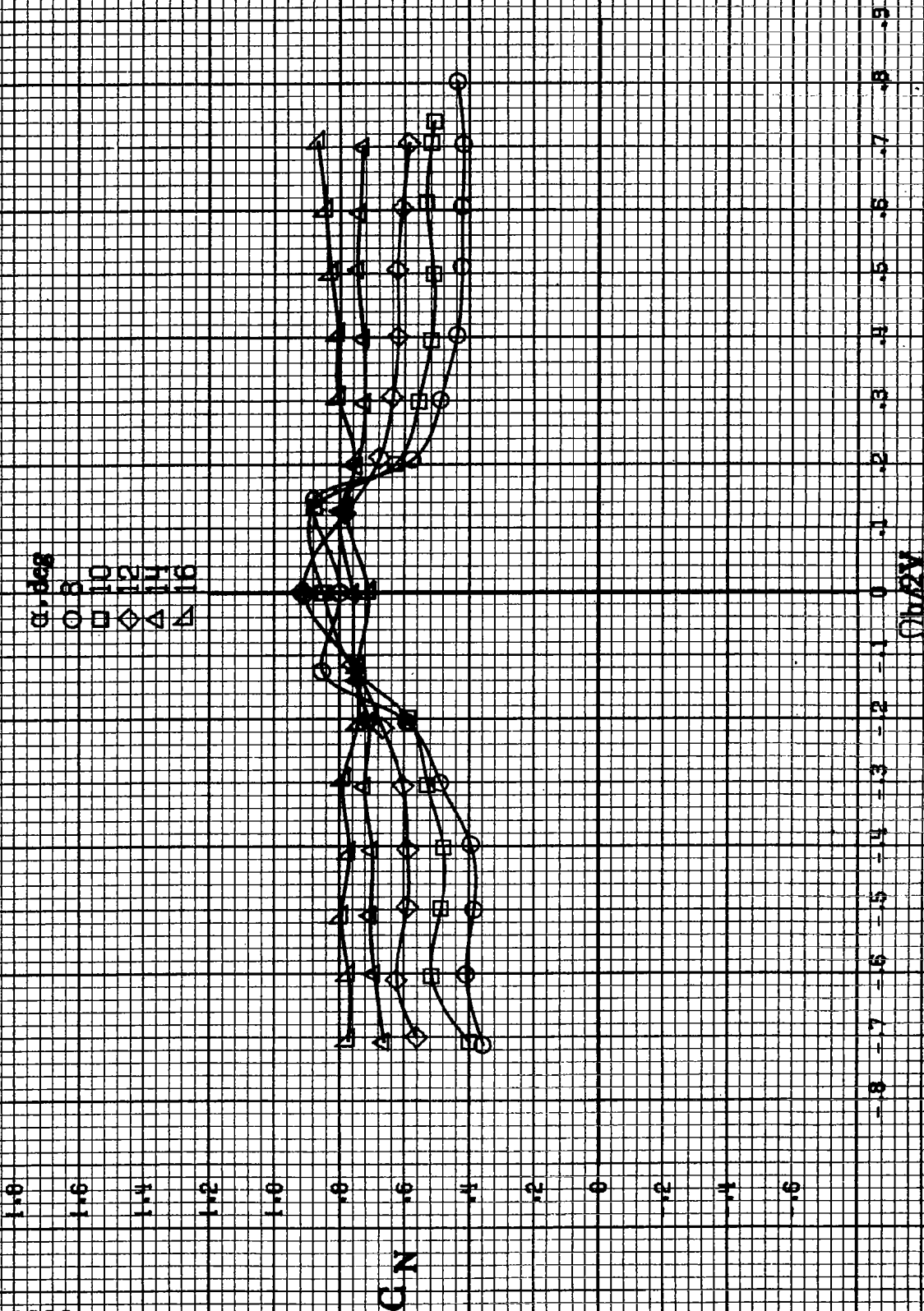


Figure A164.-Effect of rotation rate and angle of attack on normalized force coefficient for no. 1 horizontal tail configuration.  $\delta_a = -15^\circ$ ,  $\delta_s = -25^\circ$ ,  $\delta = 0^\circ$ .

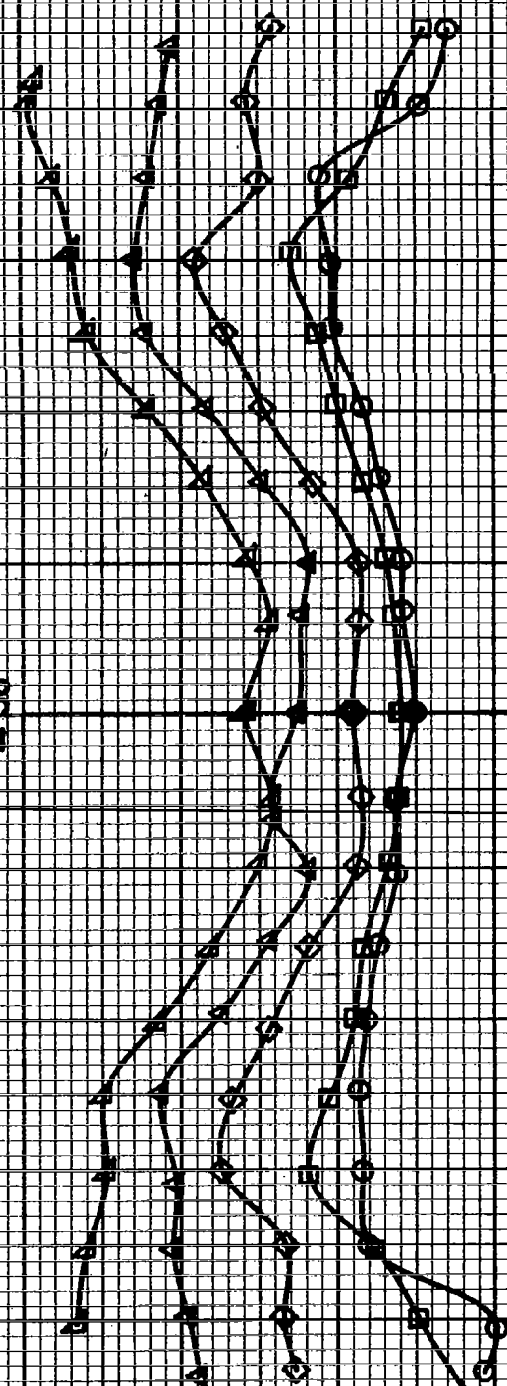
2.4  
2.2  
2.0  
1.8  
1.6  
1.4  
1.2  
1.0  
.8  
.6  
.4  
.2  
0

ClN

Ch/2V

-1.8 -1.7 -1.6 -1.5 -1.4 -1.3 -1.2 -1.1 0 .1 .2 .3 .4 .5 .6 .7 .8 .9

α-deg  
○ 18  
□ 20  
◇ 26  
△ 30  
▽ 35



(b) α=18 to 35 deg, SR=162.9 cm (72 in).

Figure A184-Continued.

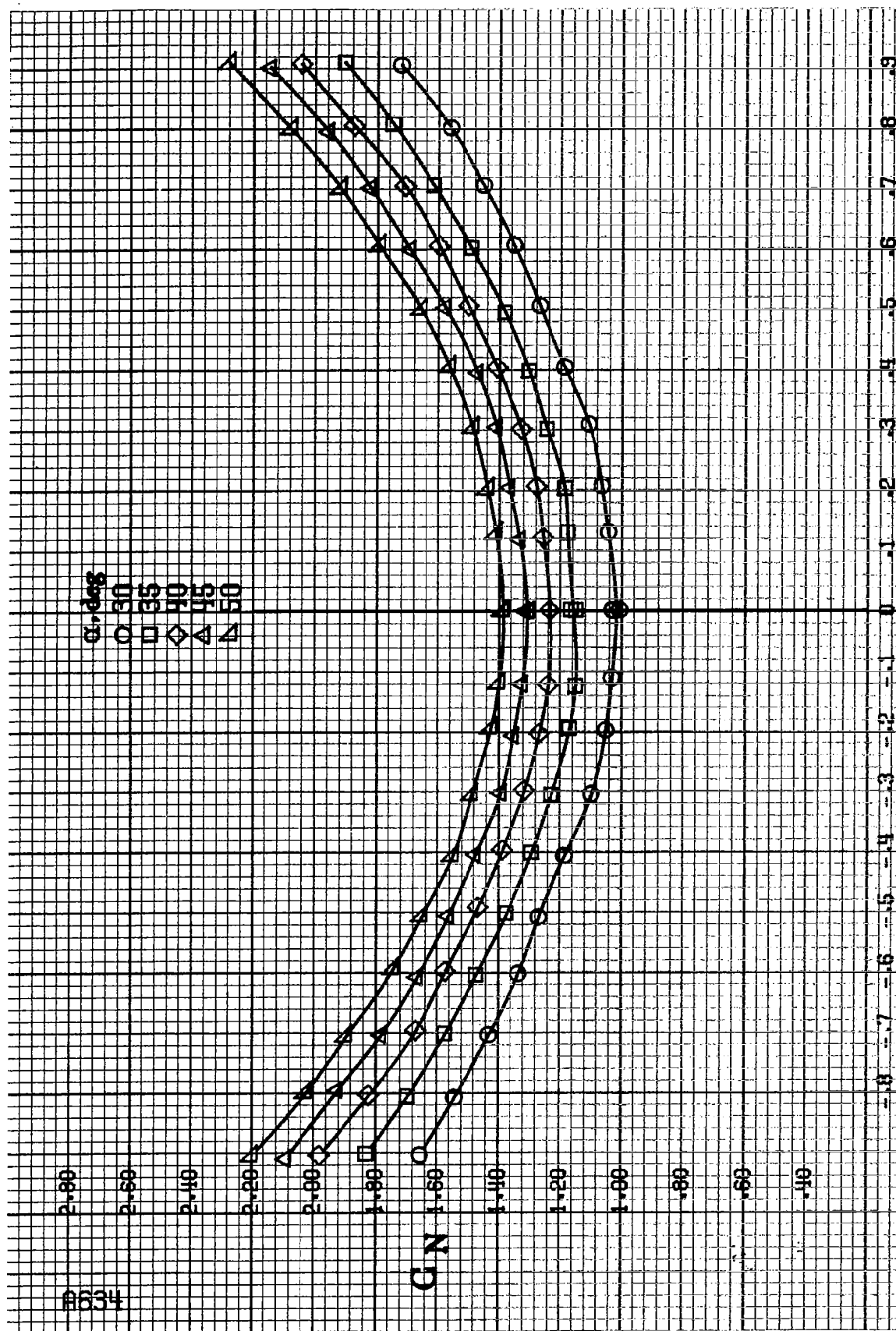
#634

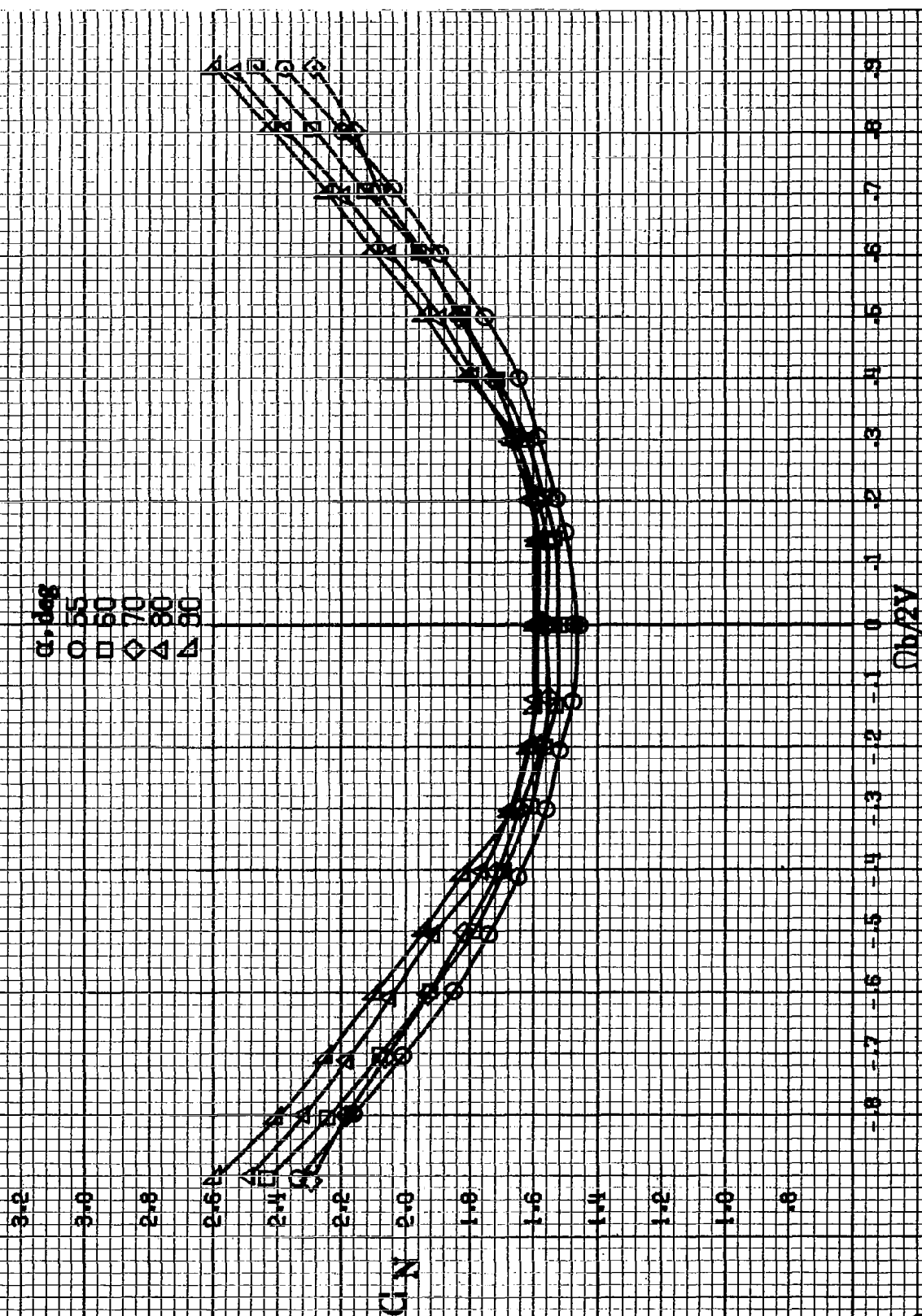
$\alpha, \text{deg}$   
 O 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▲ 50

C/N

$\Omega_b/2V$

(c)  $\alpha=30$  to  $50$  deg,  $SR=0$ .  
 Figure A.184-Continued.





(d)  $\alpha=55$  to  $90^\circ$ ,  $SR=0$ .  
Figure A154. Continued.

8636

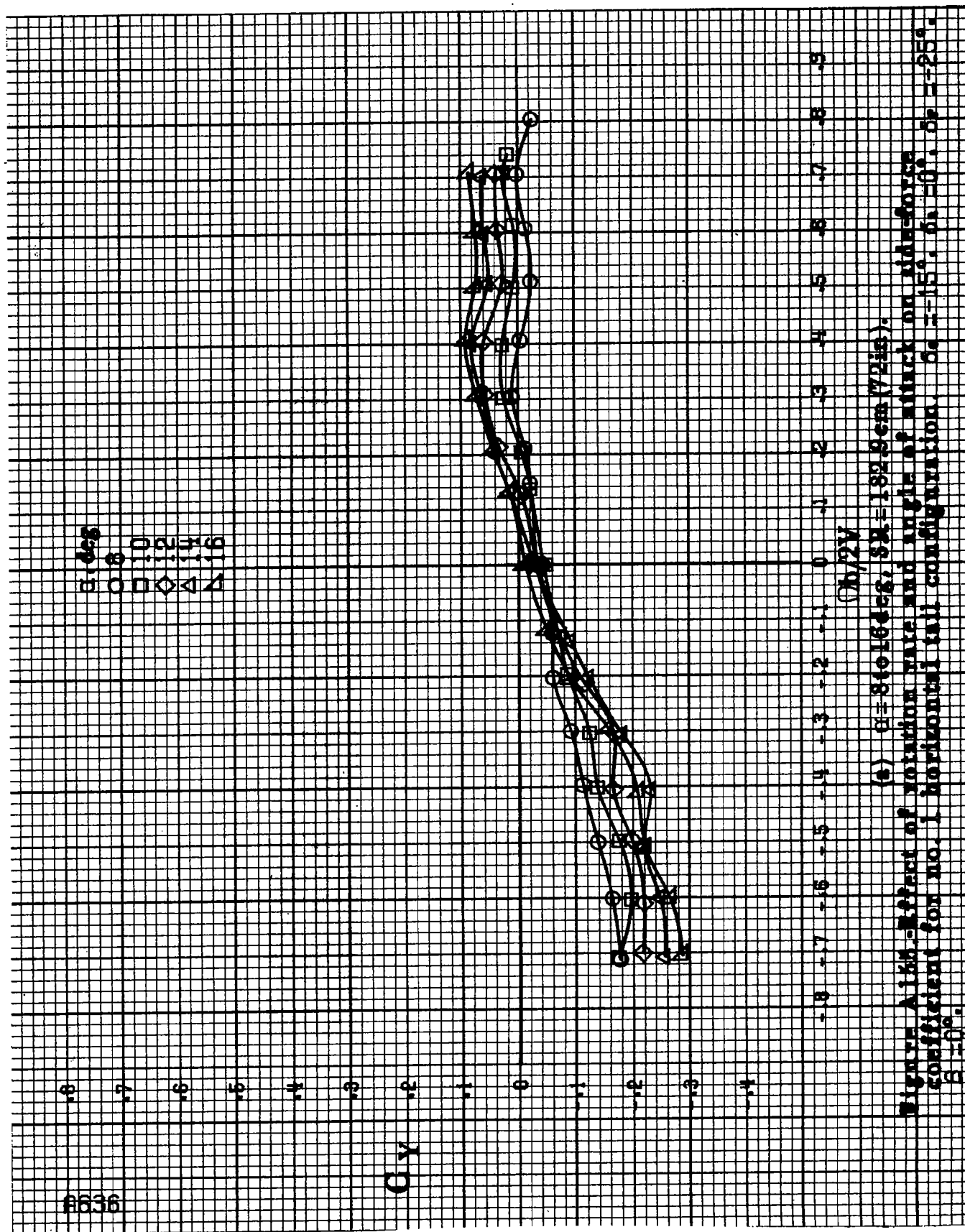
$\alpha, \text{deg}$   
 0 5 10 15 20

$C_Y$

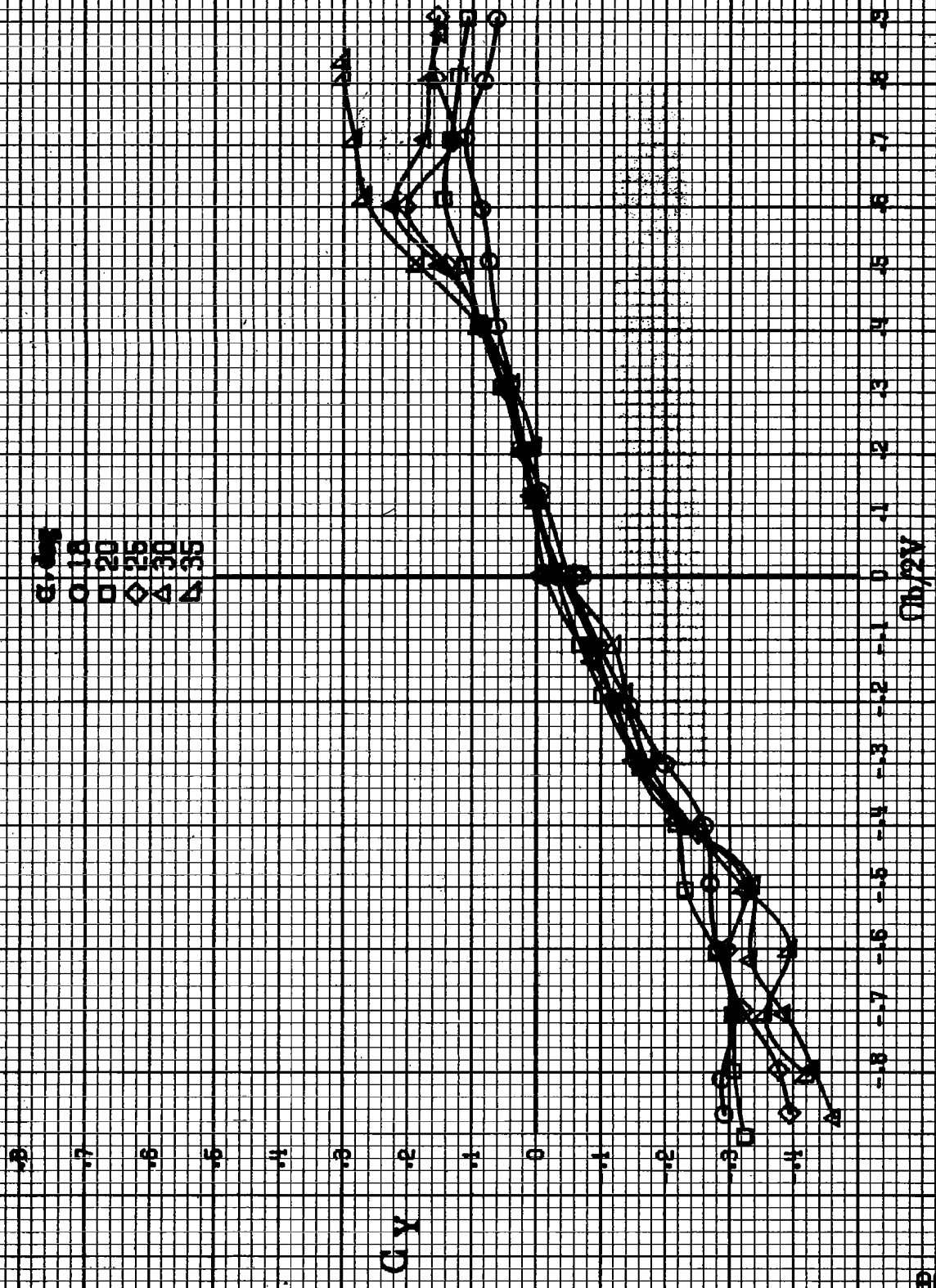
$h/2V$

(a)  $\alpha = 8.16 \text{ deg}$ ,  $S_L = 132.9 \text{ cm}^2$  (72 in<sup>2</sup>).

Figure 1.14. Effect of variation rate and angle of attack on side-force coefficient for no. 1 horizontal tail configuration.  $\delta_a = -15^\circ$ ,  $\delta_s = 0^\circ$ ,  $\delta_r = -25^\circ$ ,  $\beta = 0^\circ$ .







(b)  $\alpha=18$  to  $55$  deg, SR=162.9 cm (72 in).  
Figure A18b, Continued.

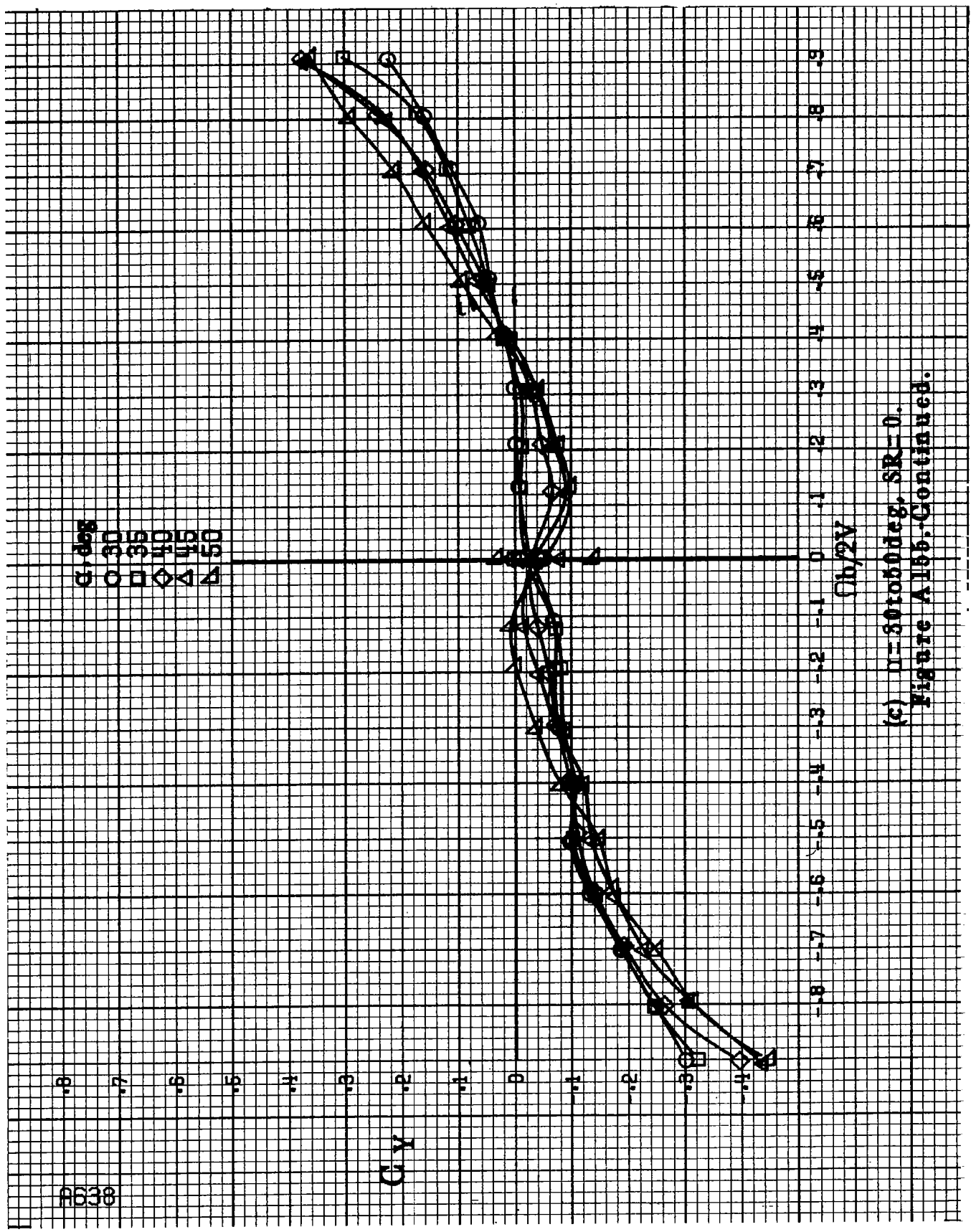
8638

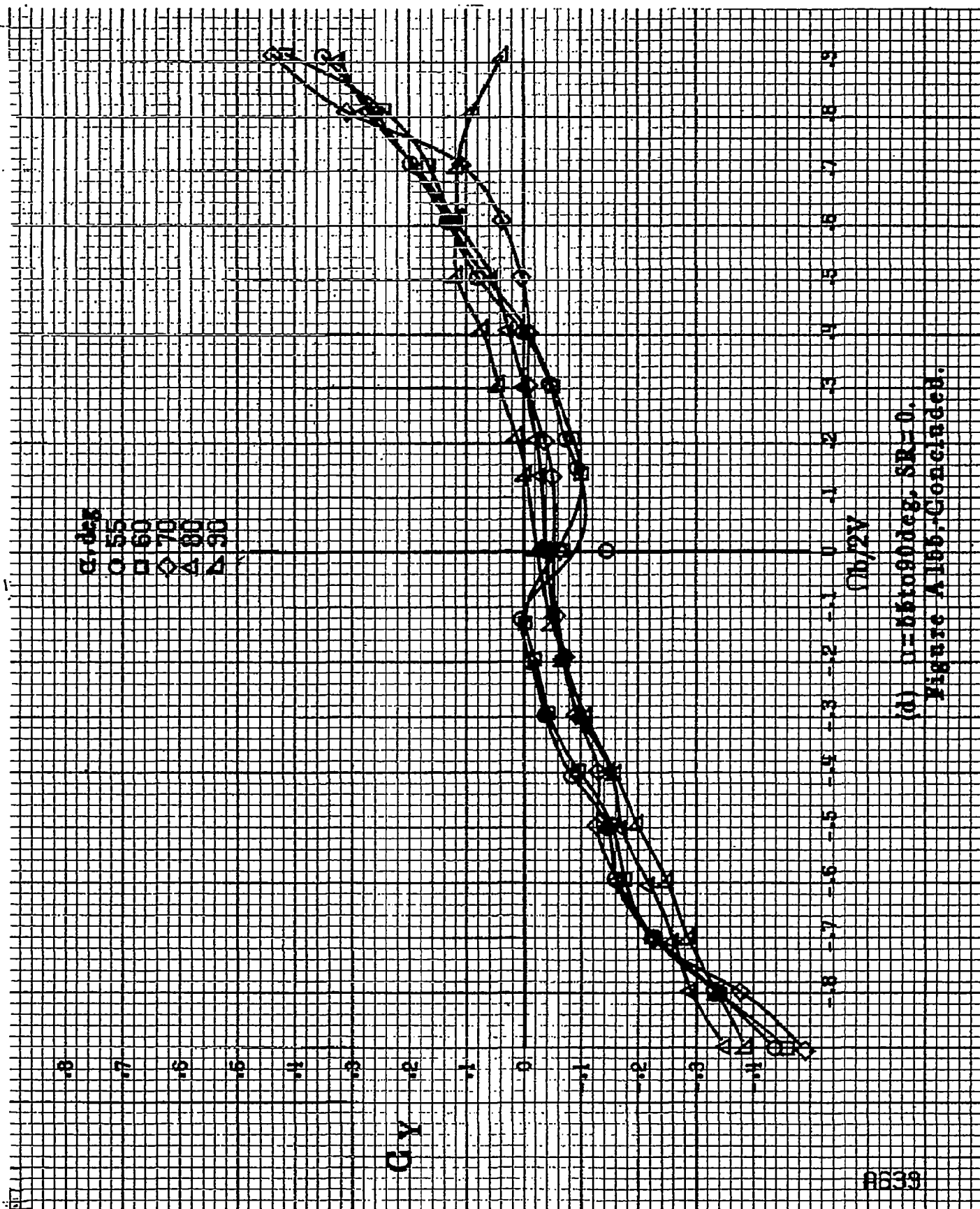
$\circ$  30  
 $\square$  35  
 $\diamond$  40  
 $\triangle$  45  
 $\nabla$  50

$C_V$

$\phi_b, 2V$

(c)  $\mu = 50$  to  $500$  deg,  $SR = 0$ .  
 Figure A15b-Continued.





(d)  $\alpha = 55$  to  $90$  deg,  $SR = 0$ .  
Figure A155-Concluded.

8640

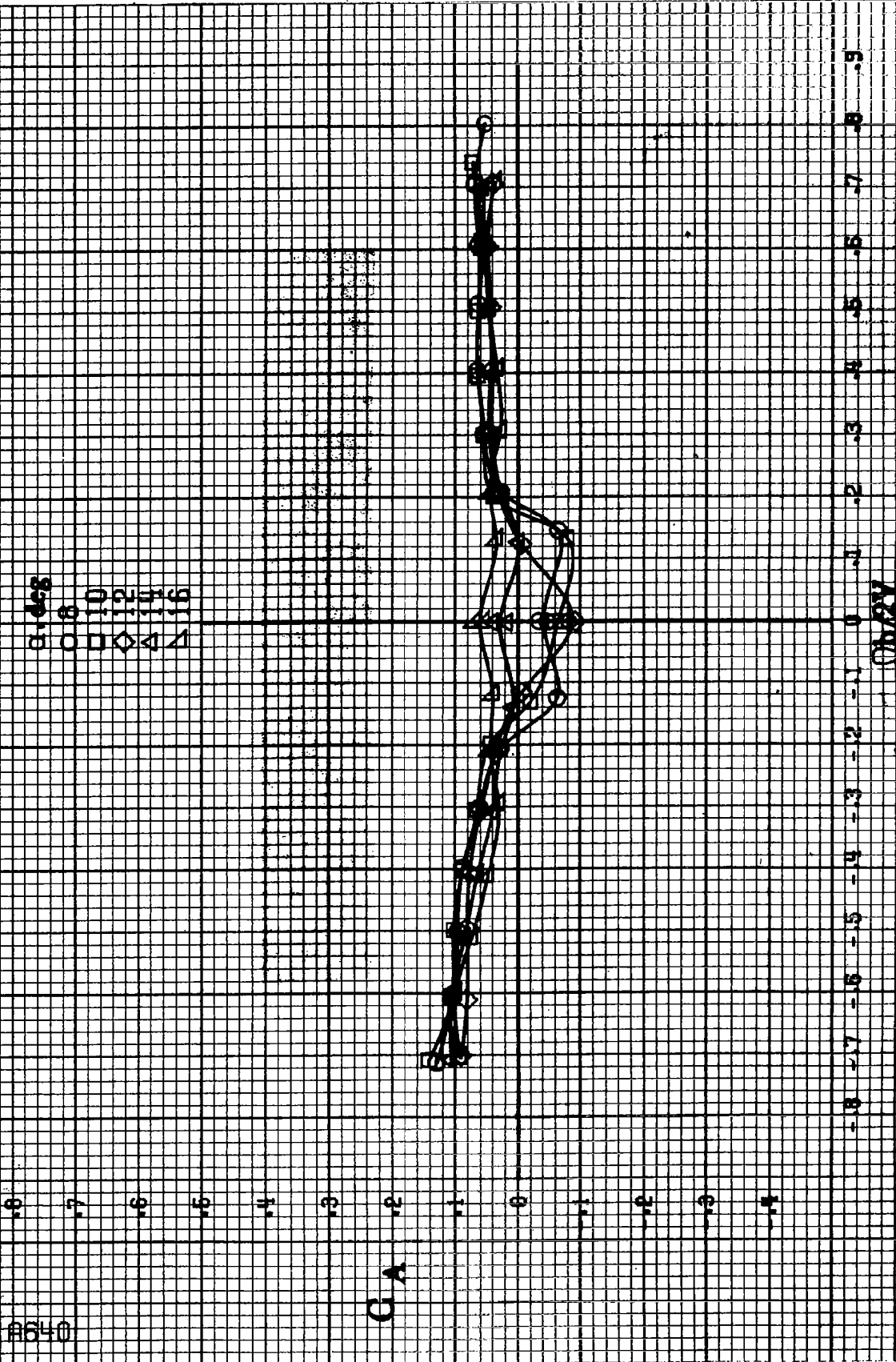


Figure A16. Effect of mutation rate and angle of attack on coefficient for no. 1 horizontal tail configuration.  $S = 100$  sq ft,  $b = 10$  ft,  $c = 86018$  deg,  $S_M = 182.9$  cm (72 in).

G, deg  
 O 18  
 □ 20  
 ◇ 25  
 △ 30  
 ▲ 35

C.A.

$\phi_{h/2V}$

(b)  $\alpha = 16$  to  $35$  deg,  $SR = 182.9$  cm (72 in).  
 Figure A166, Continued.

804

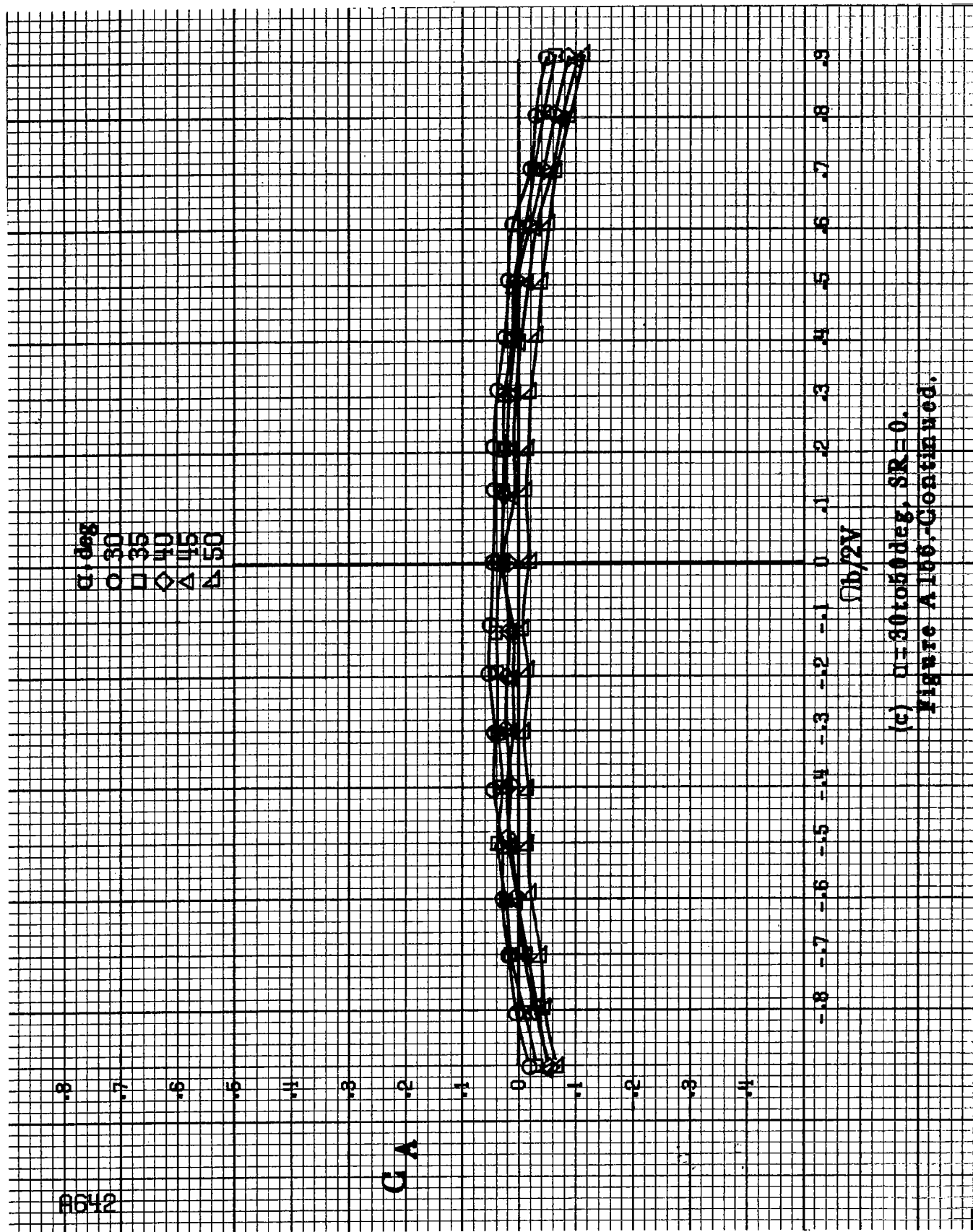
RG42

$\alpha$ , deg  
 ○ 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▲ 50

$G_A$

$\Omega b/2V$

(c)  $\Omega = 30$  to  $50$  deg,  $SR = 0$ .  
 Figure A105-Continued.

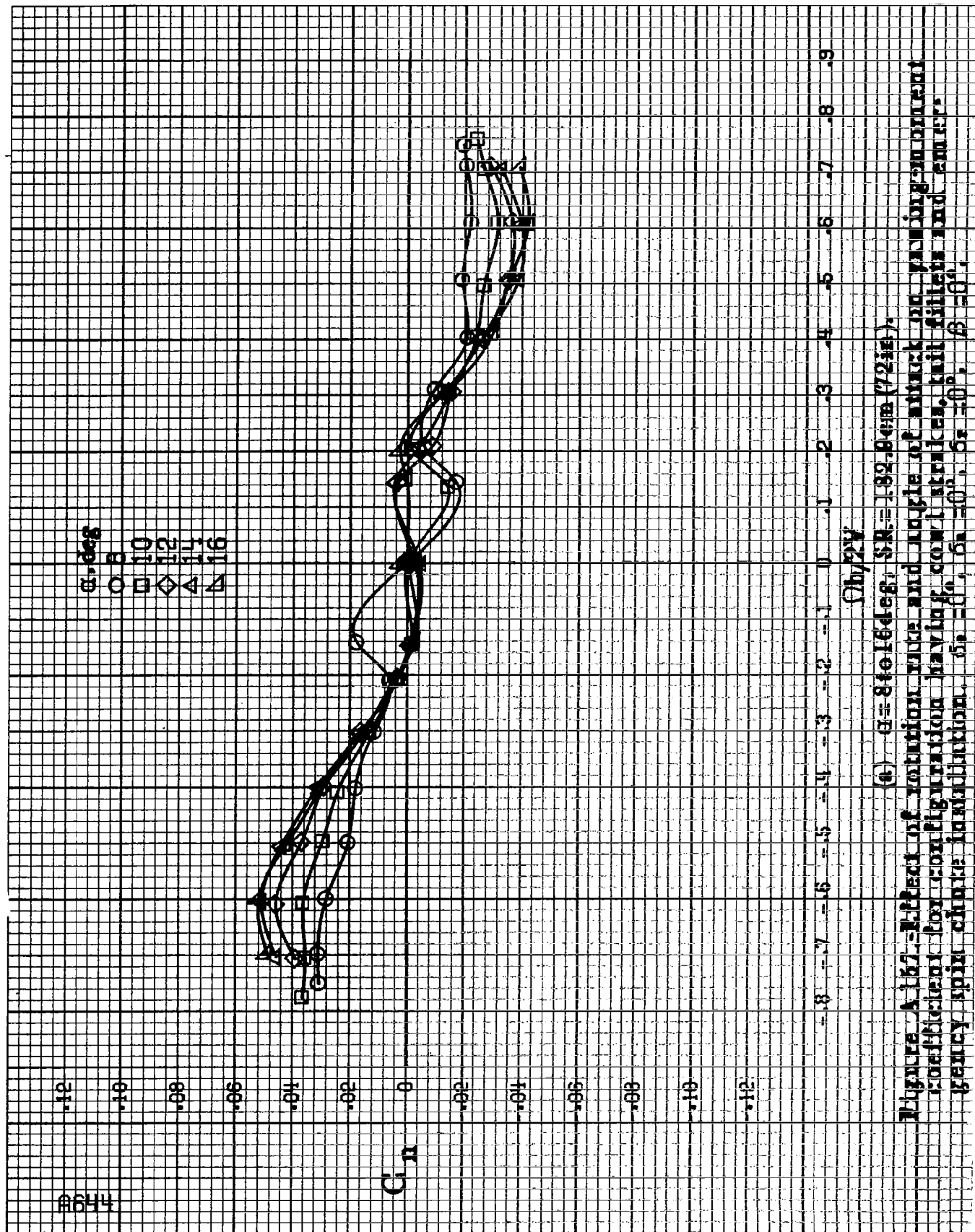


$\alpha$ , deg  
 O 55  
 □ 60  
 ◇ 70  
 △ 80  
 ▲ 90

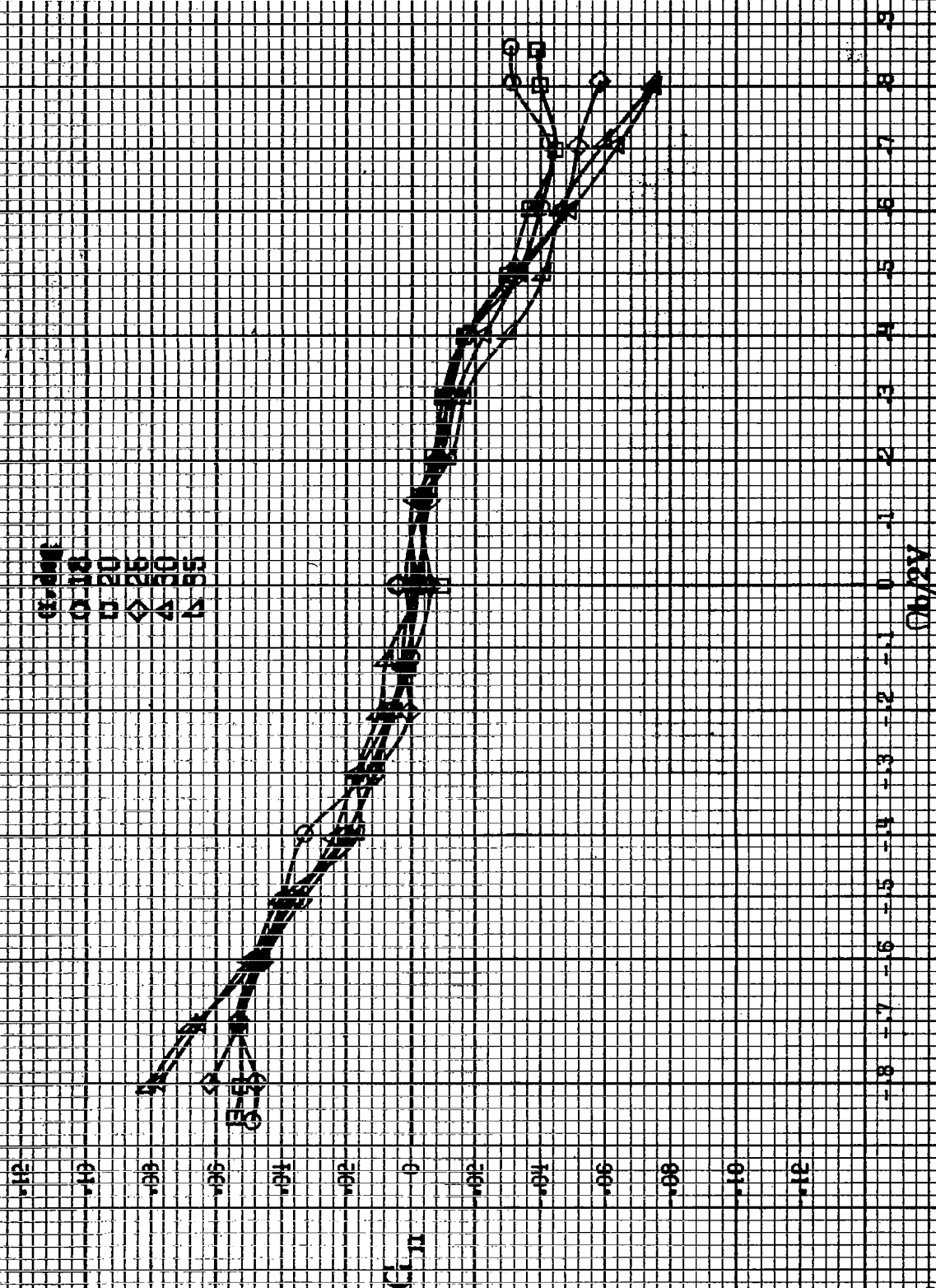
Cl A

$\Omega b/2V$

(d)  $\alpha = 55$  to  $90$  deg,  $SR = 0$ .  
 Figure A186-Continued.

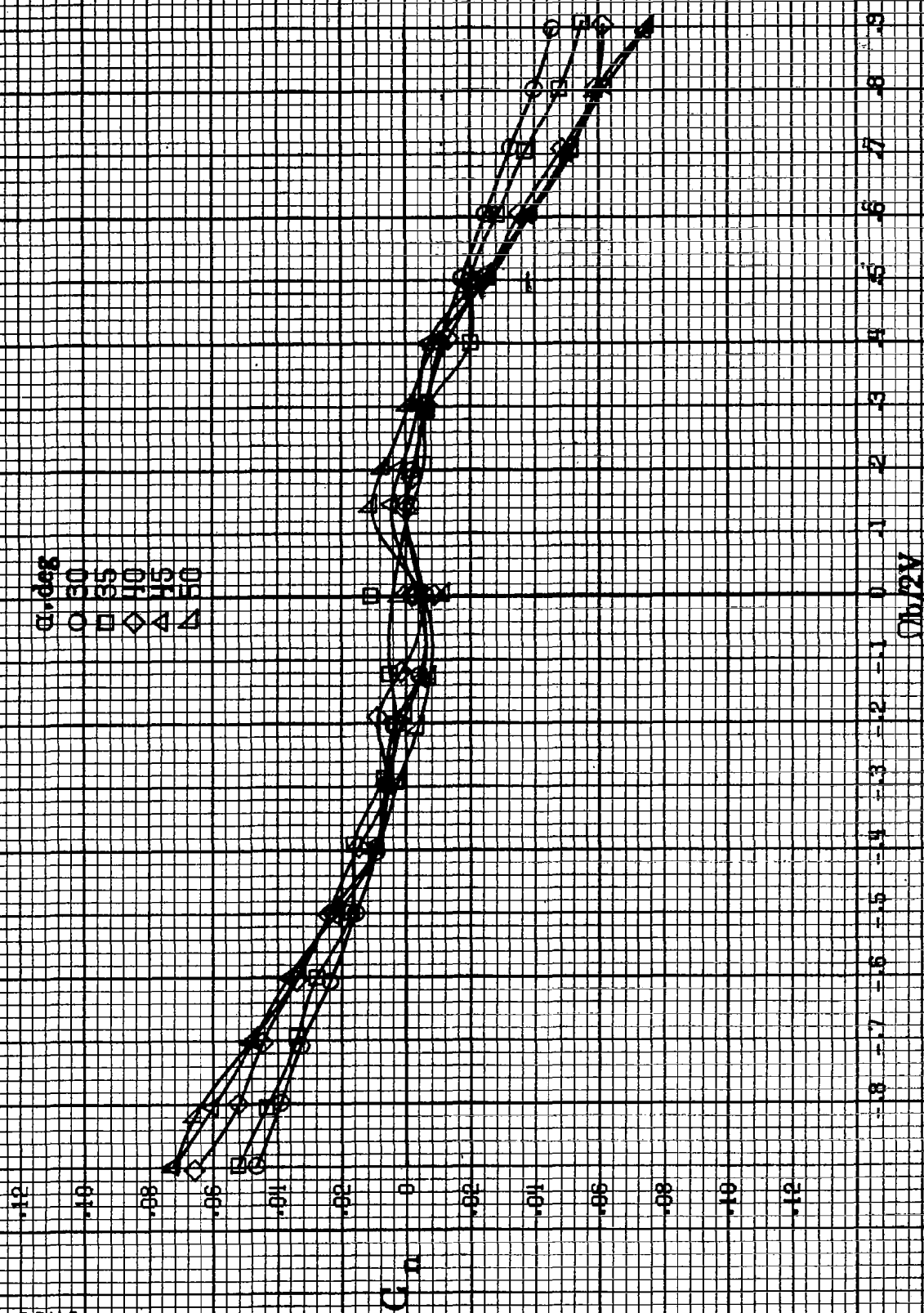






(b)  $n=1.6$  to  $5.5$  deg,  $SR=182.9$  cm (72 in).  
Figure A167. Continued.

8646



(c)  $\mu = 30$  to 50 deg,  $SR = 0$ .  
Figure A157, Continued.

$\alpha, \text{deg}$

○ 55  
□ 60  
◇ 70  
△ 80  
▽ 90

$C_{\pi}$

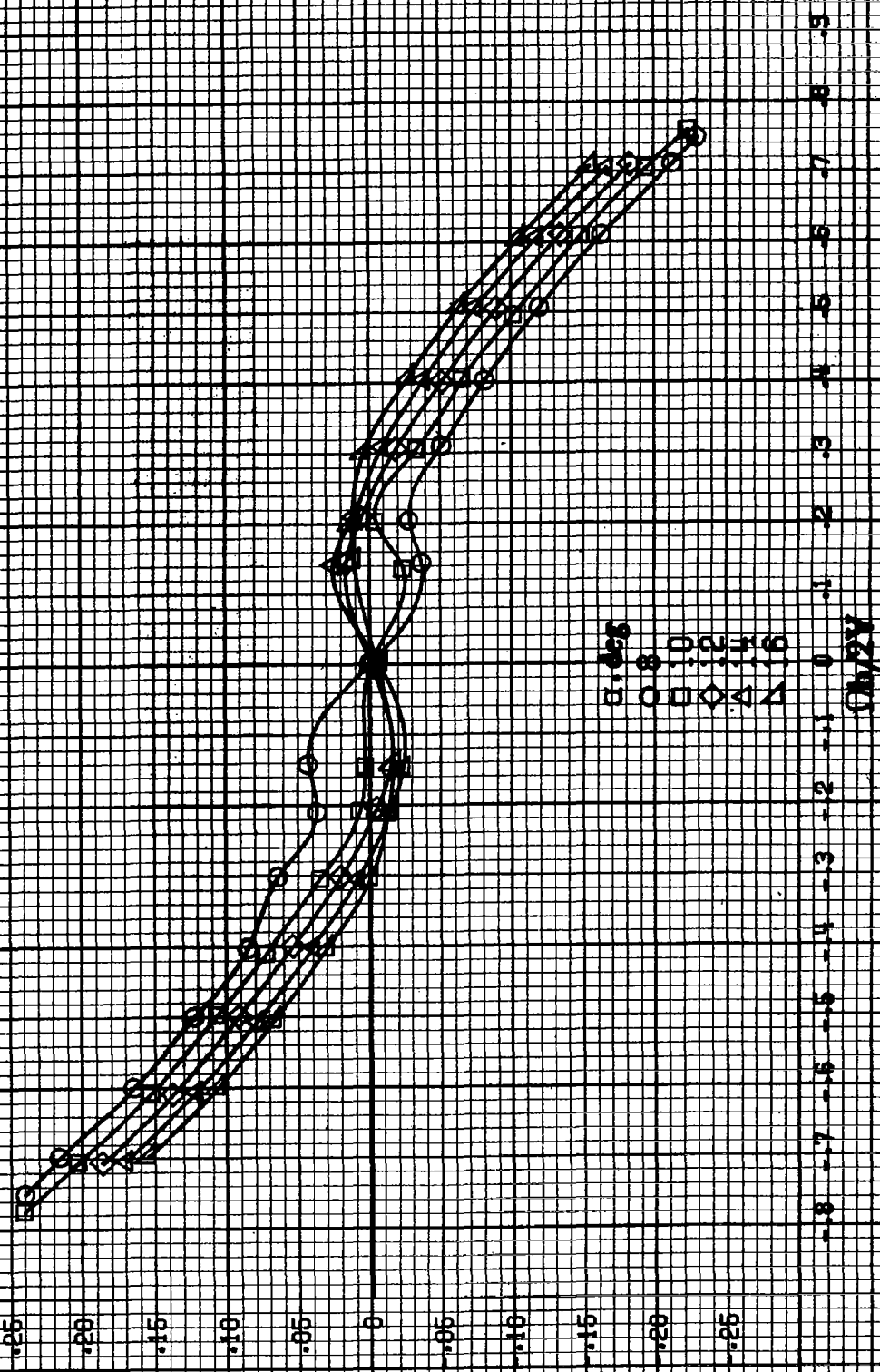
$\phi_b/2V$

(d)  $\mu = 55 \text{ to } 90 \text{ deg}$ ,  $SR = 0$ .  
Figure A157. Concluded.

A647

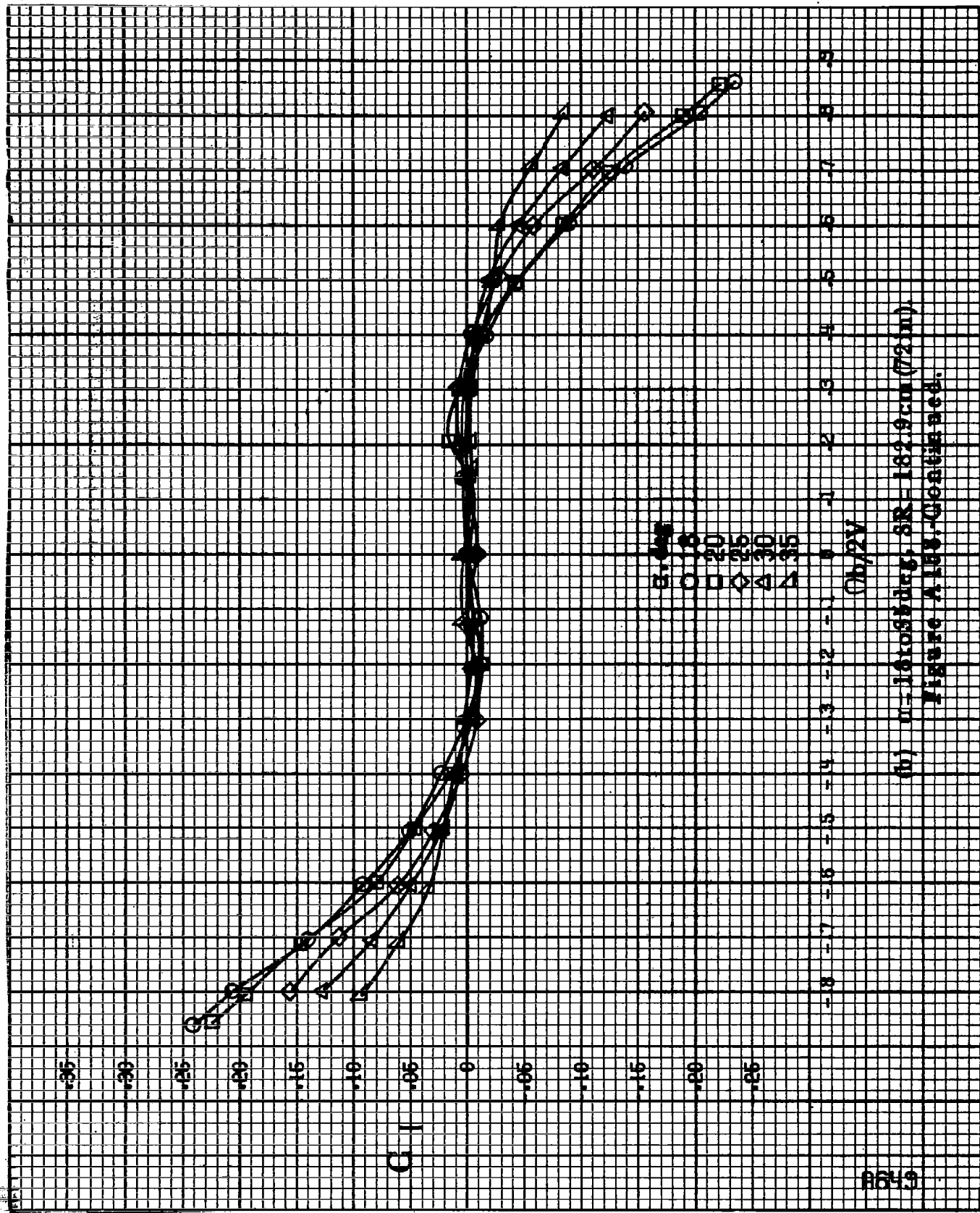
8648

$C_L$



(6)  $\alpha = 8.0164 \text{ deg}$ ,  $SM = 132.9 \text{ cm (72 in)}$ .

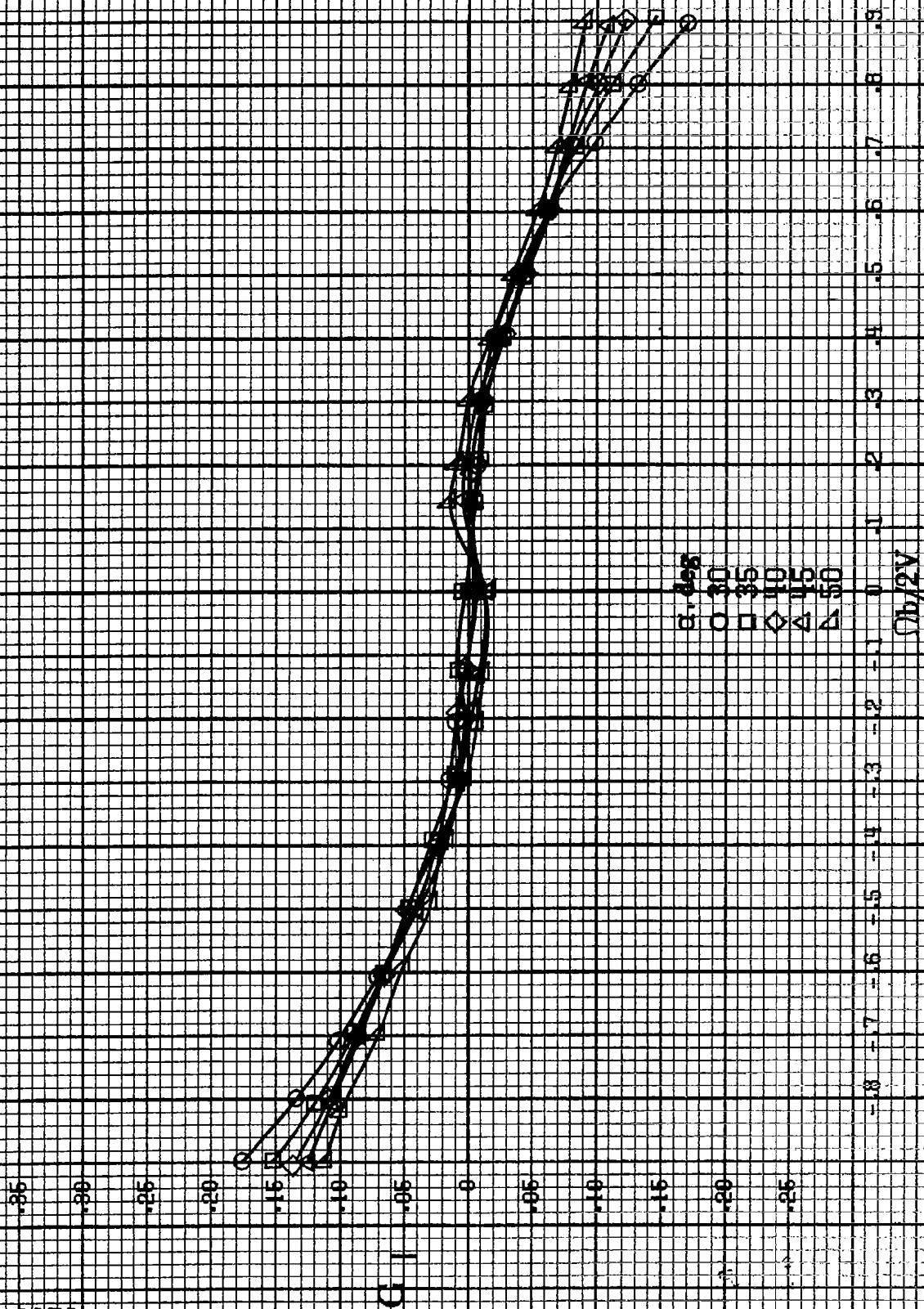
Figure A.116 - Effect of variation rate and angle of attack of attack on rolling moment coefficient for configurations having conical strakes, tail fillets and emergency spin chute installation.  $\phi = 0^\circ$ ,  $\phi = 0^\circ$ ,  $\phi = 0^\circ$ ,  $\phi = 0^\circ$ .



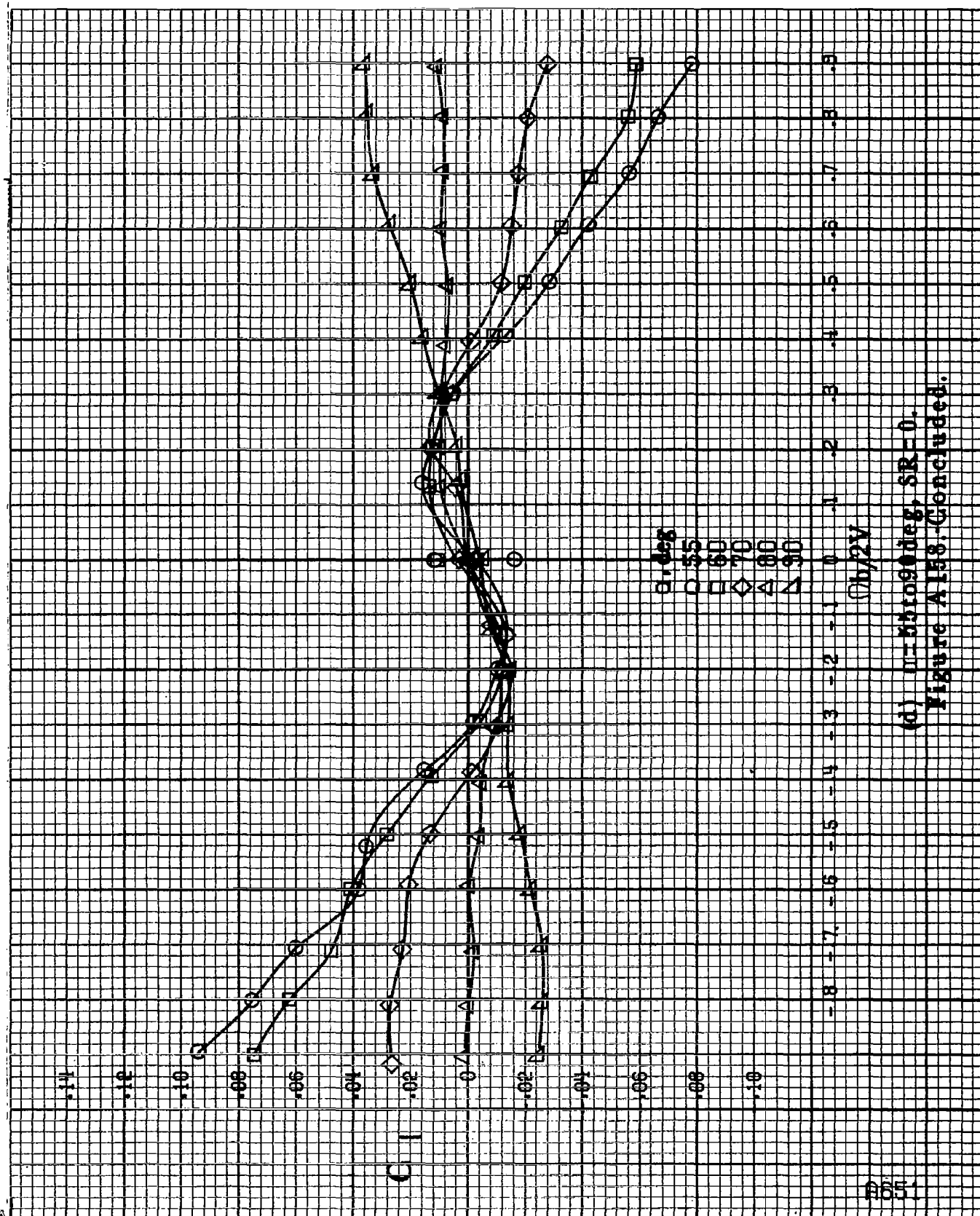
(b)  $n=1.6$  to  $3.5$  deg,  $SR=182.9$  cm (72 in).

Figure A.18V-Continued.

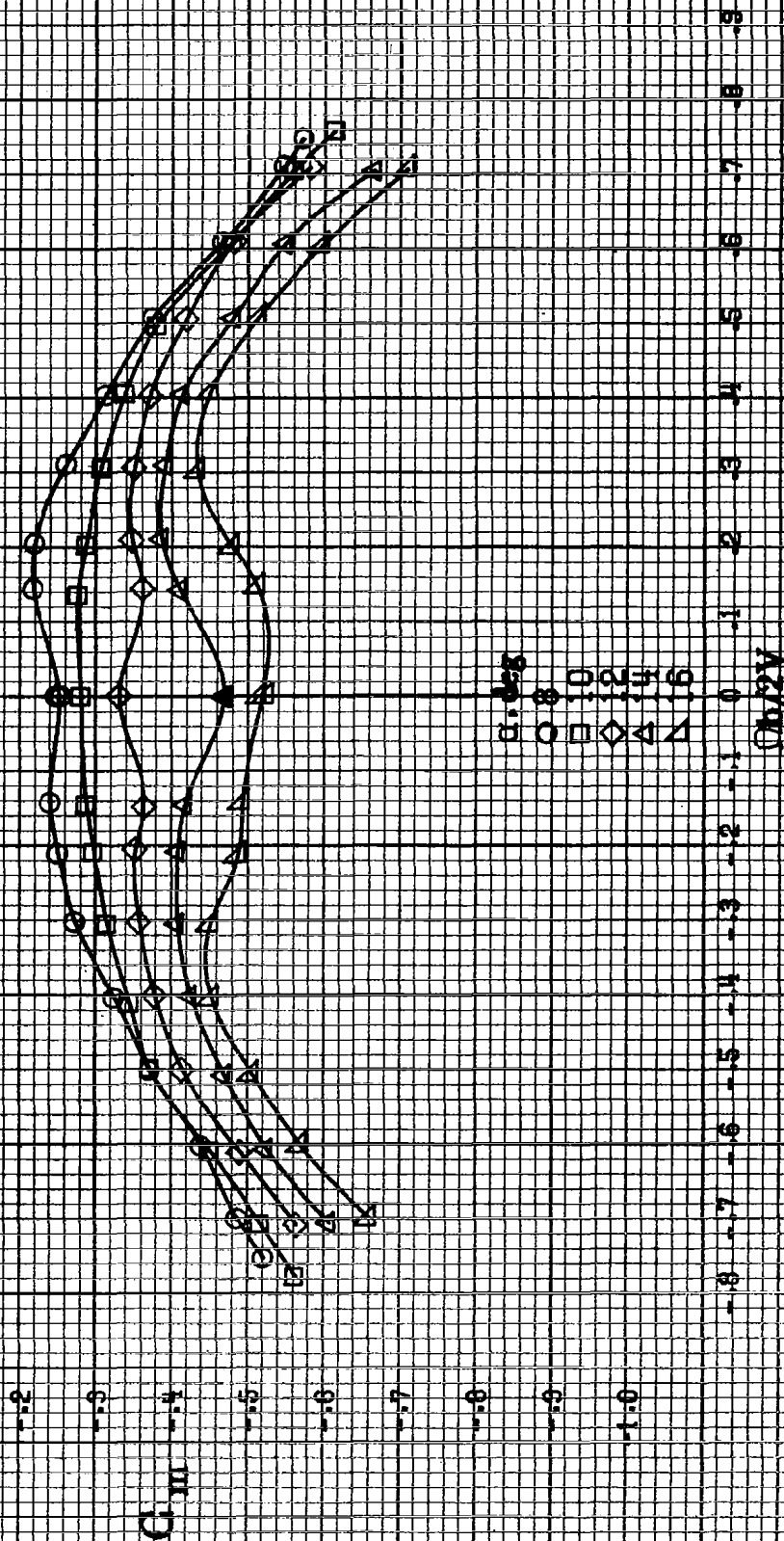
A650



(c)  $n=30$  to  $50$  deg,  $SR=0$ .  
Figure A188-Continued.

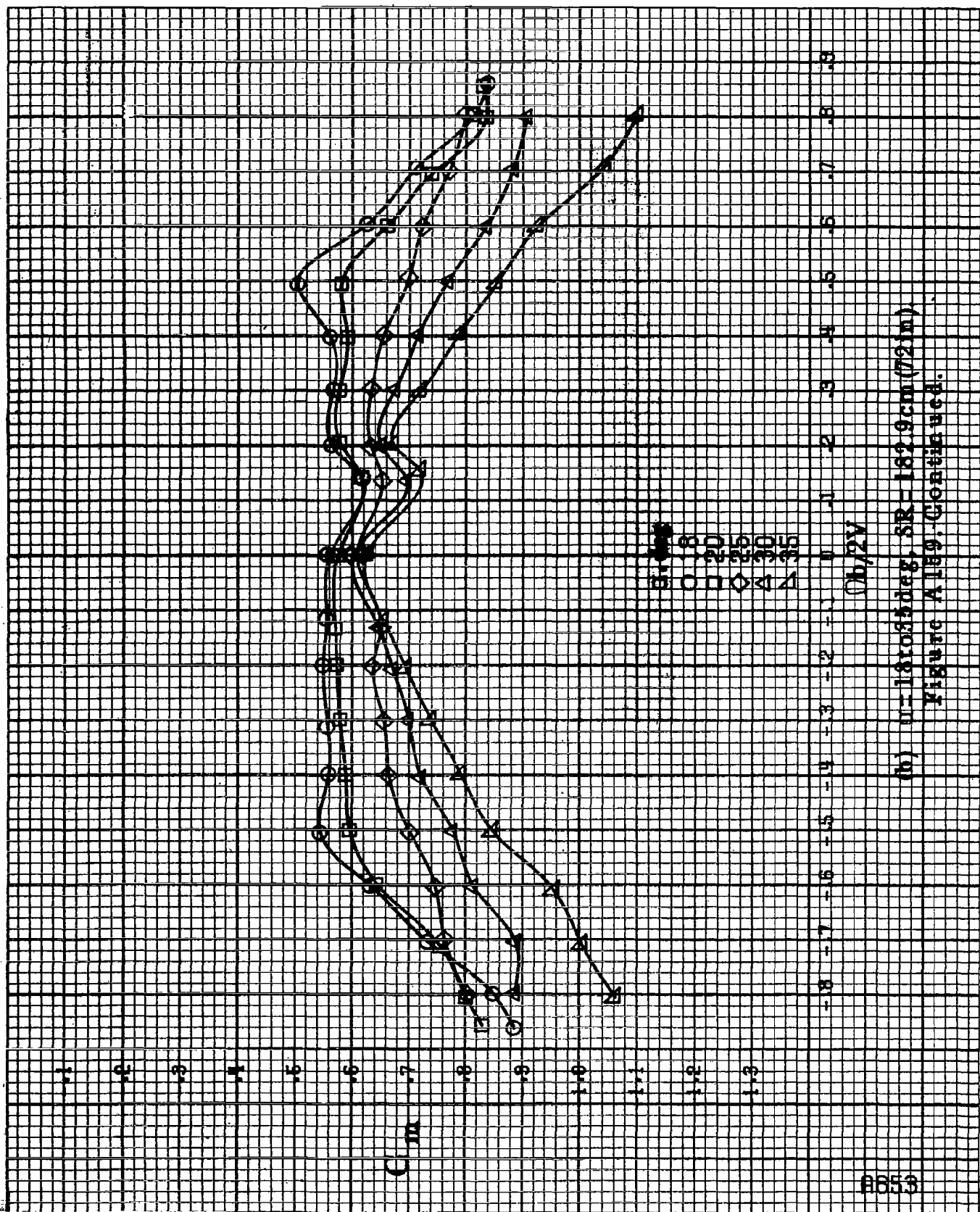


(d)  $\theta = 55$  to  $90$  deg,  $SR = 0$ .  
Figure A158. Concluded.



(a)  $\alpha = 8^\circ$  to  $16^\circ$ ,  $SR = 132.9 \text{ cm} (72 \text{ in})$ .  
 Figure A159.-Effect of rotation rate and angle of attack on pitching-moment coefficient for configuration having cowli strokes, tail fillets and emergency spin chute installation.  $\delta_a = 0^\circ$ ,  $\delta_r = 0^\circ$ ,  $\delta = 0^\circ$ .





(h)  $\omega = 16085 \text{ deg}$ ,  $SR = 182.9 \text{ cm}$  (72 in)  
Figure A159. Continued.

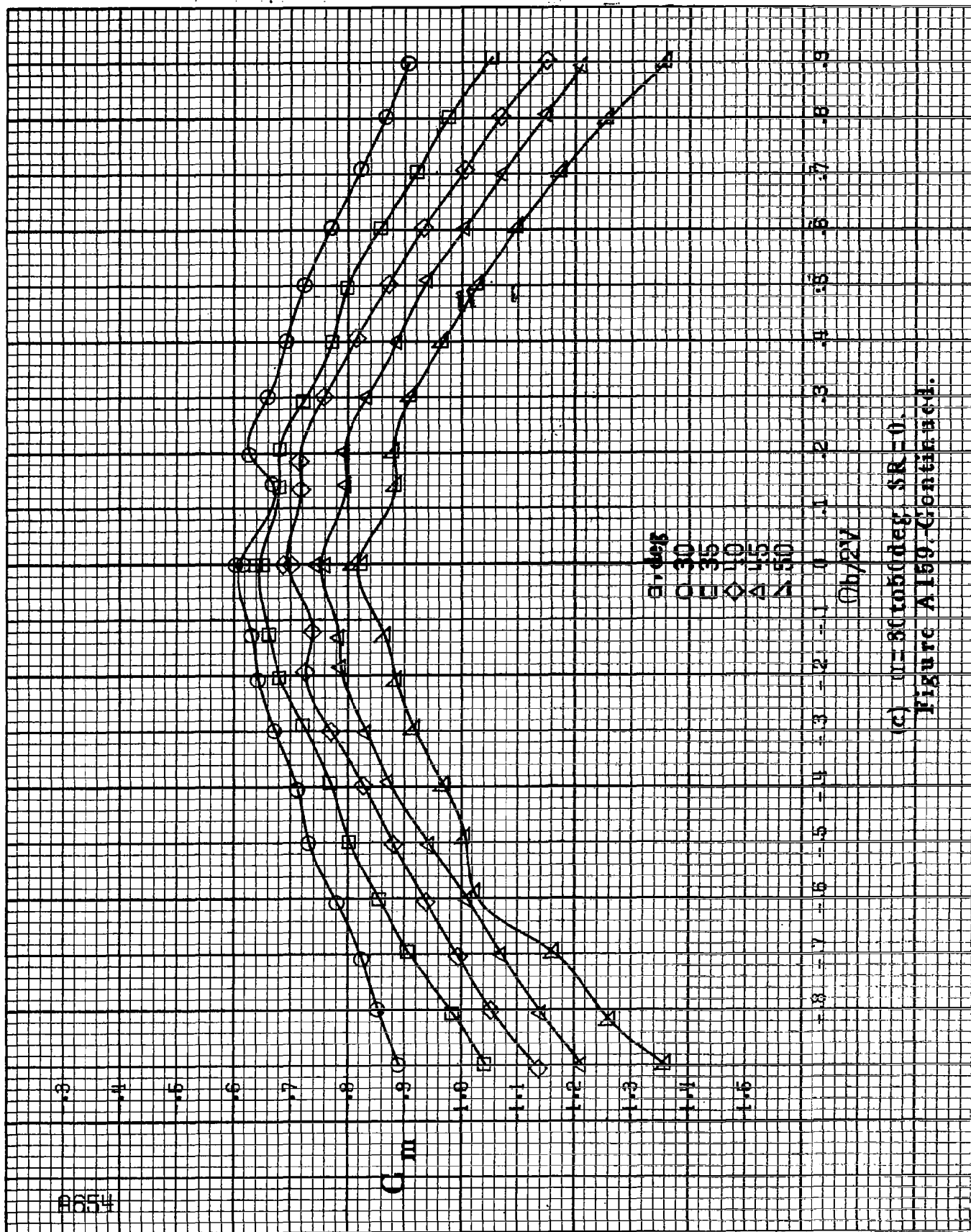
8654

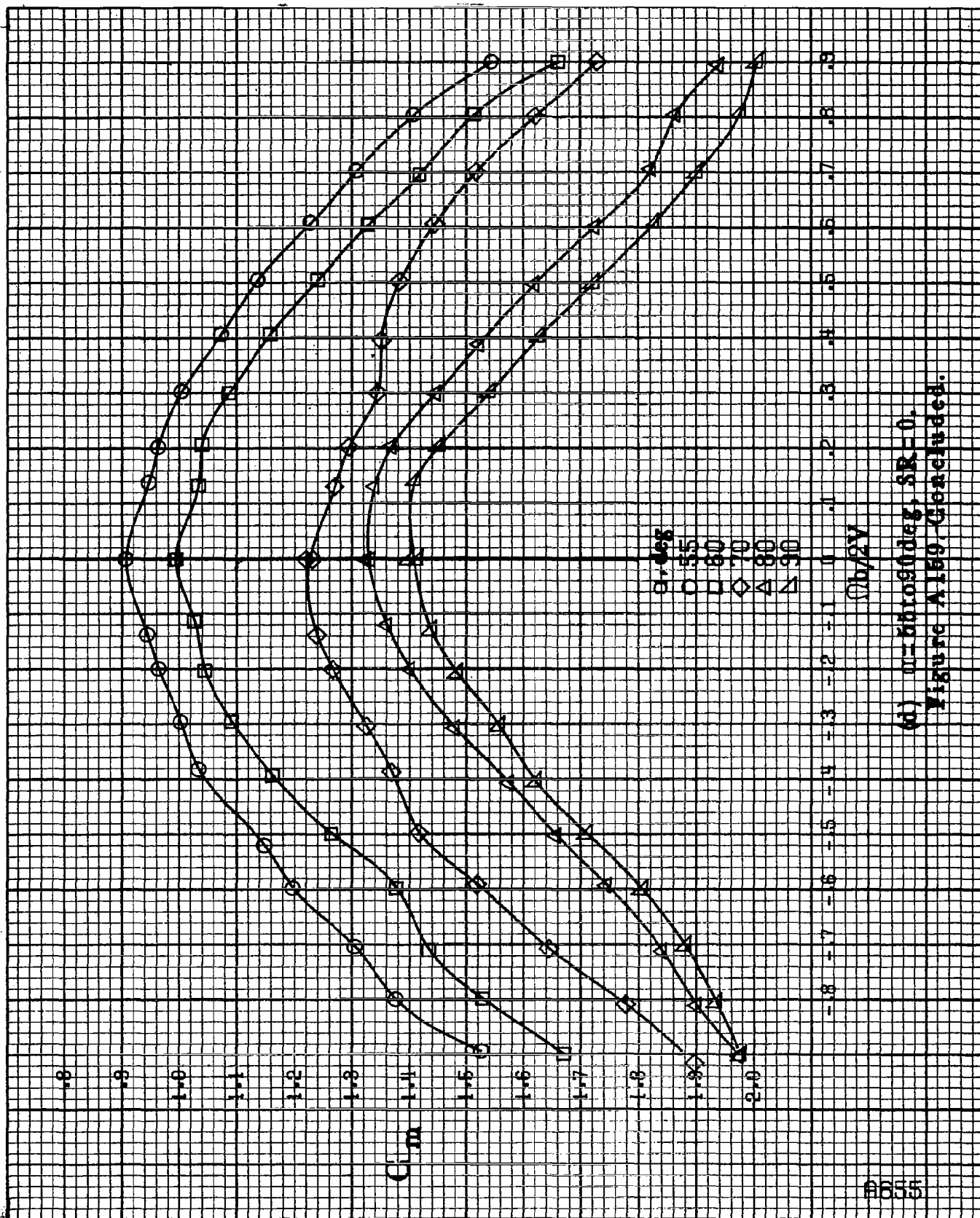
$C_m$

$\theta, \text{deg}$   
 $\circ 30$   
 $\square 35$   
 $\diamond 40$   
 $\triangle 45$   
 $\nabla 50$

$\phi_b/2^\circ$

(c)  $\eta = 30 \text{ to } 60 \text{ deg}$ ,  $SR = 0$ .  
 Figure A159. Continued.

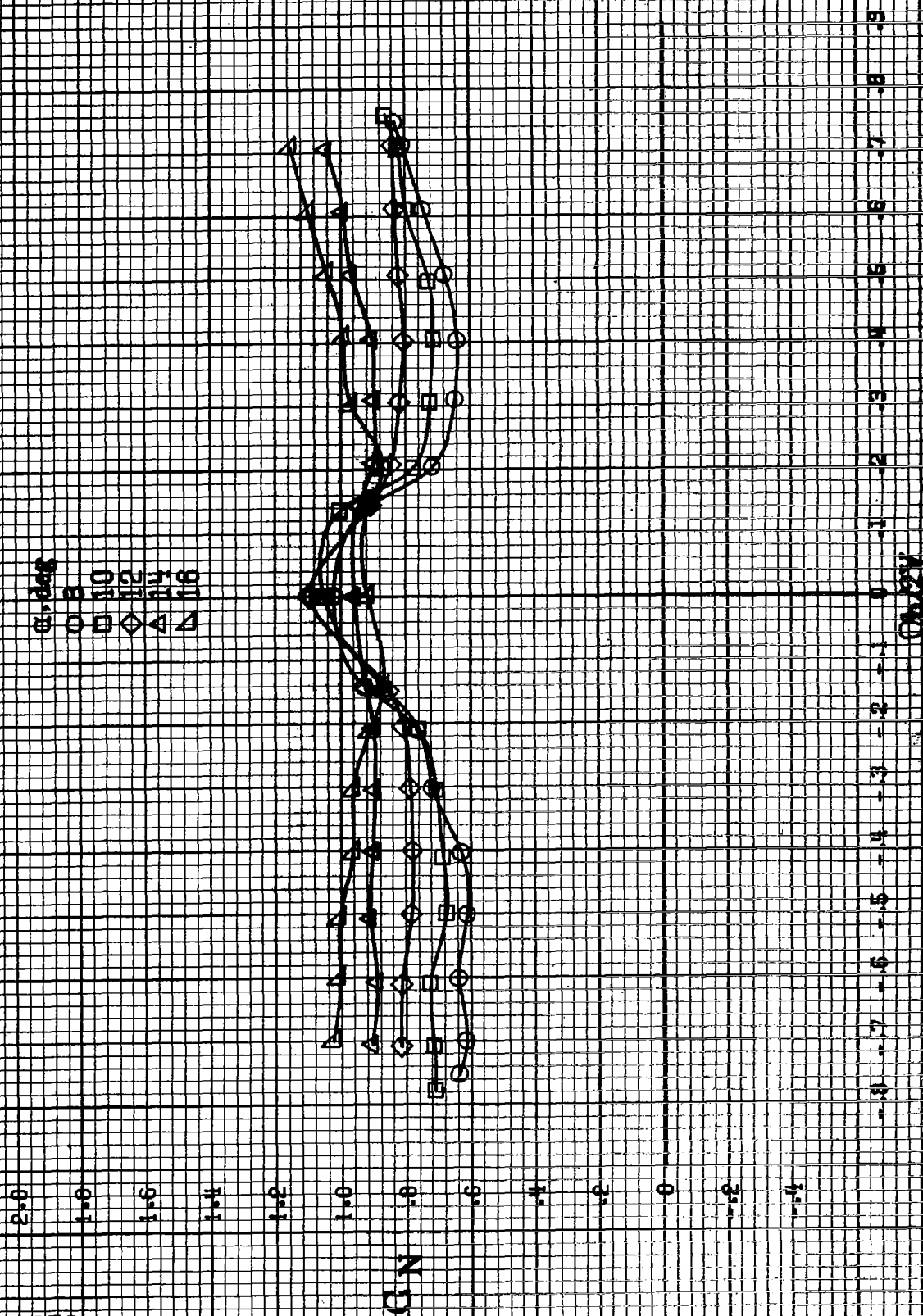




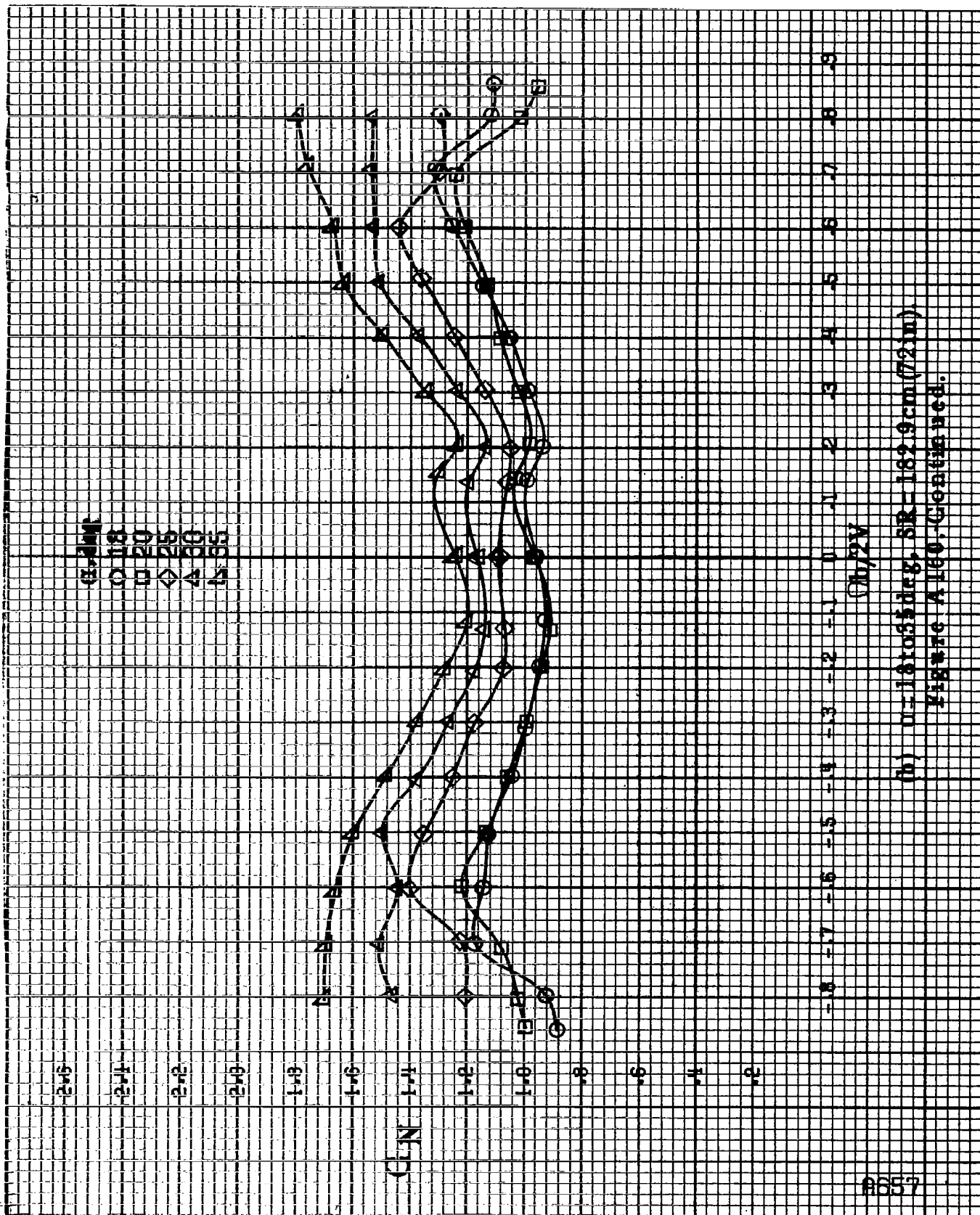
A655

(d)  $m=66.90^\circ$ ,  $SR=0$ .  
Figure A150. Concluded.

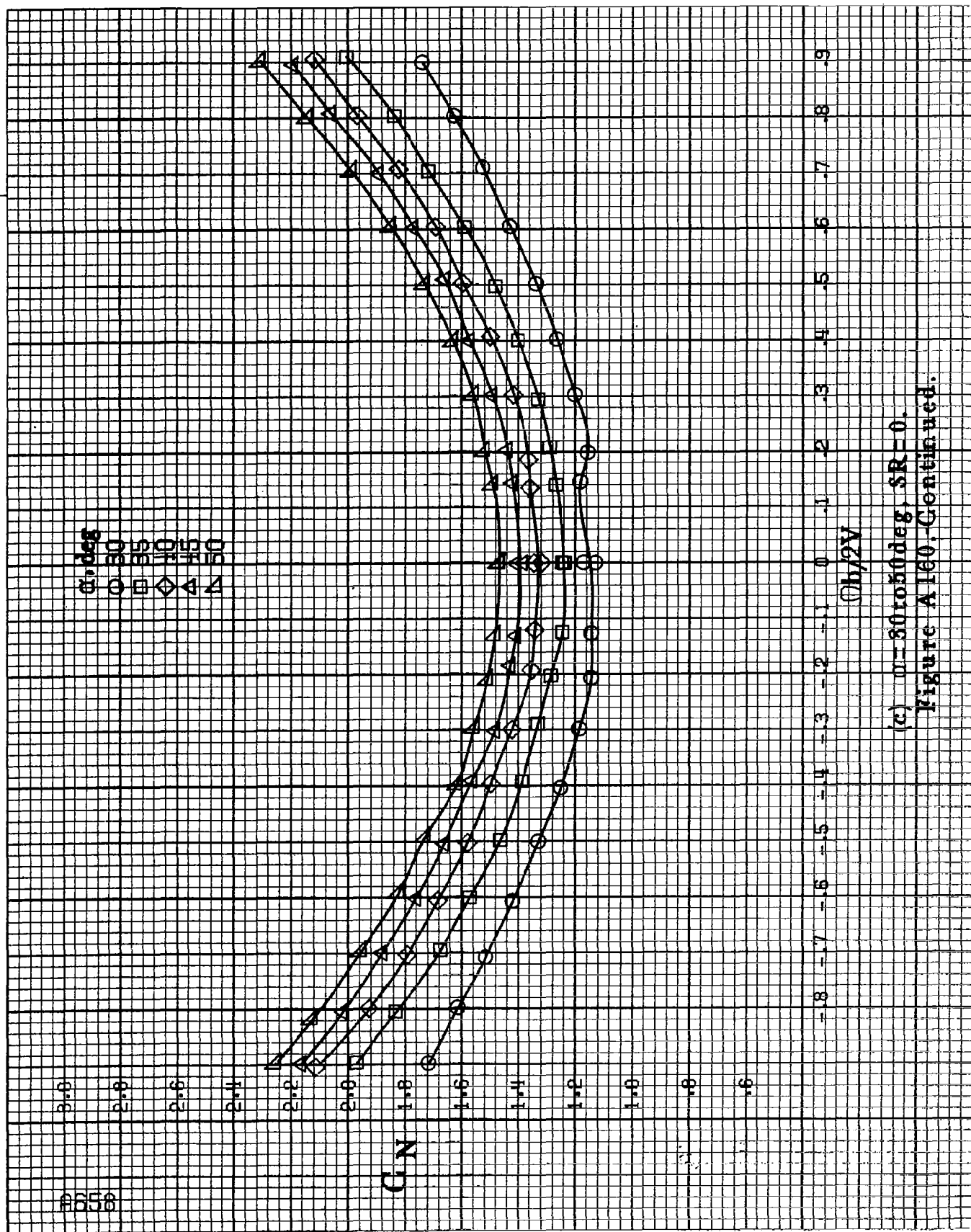
8656



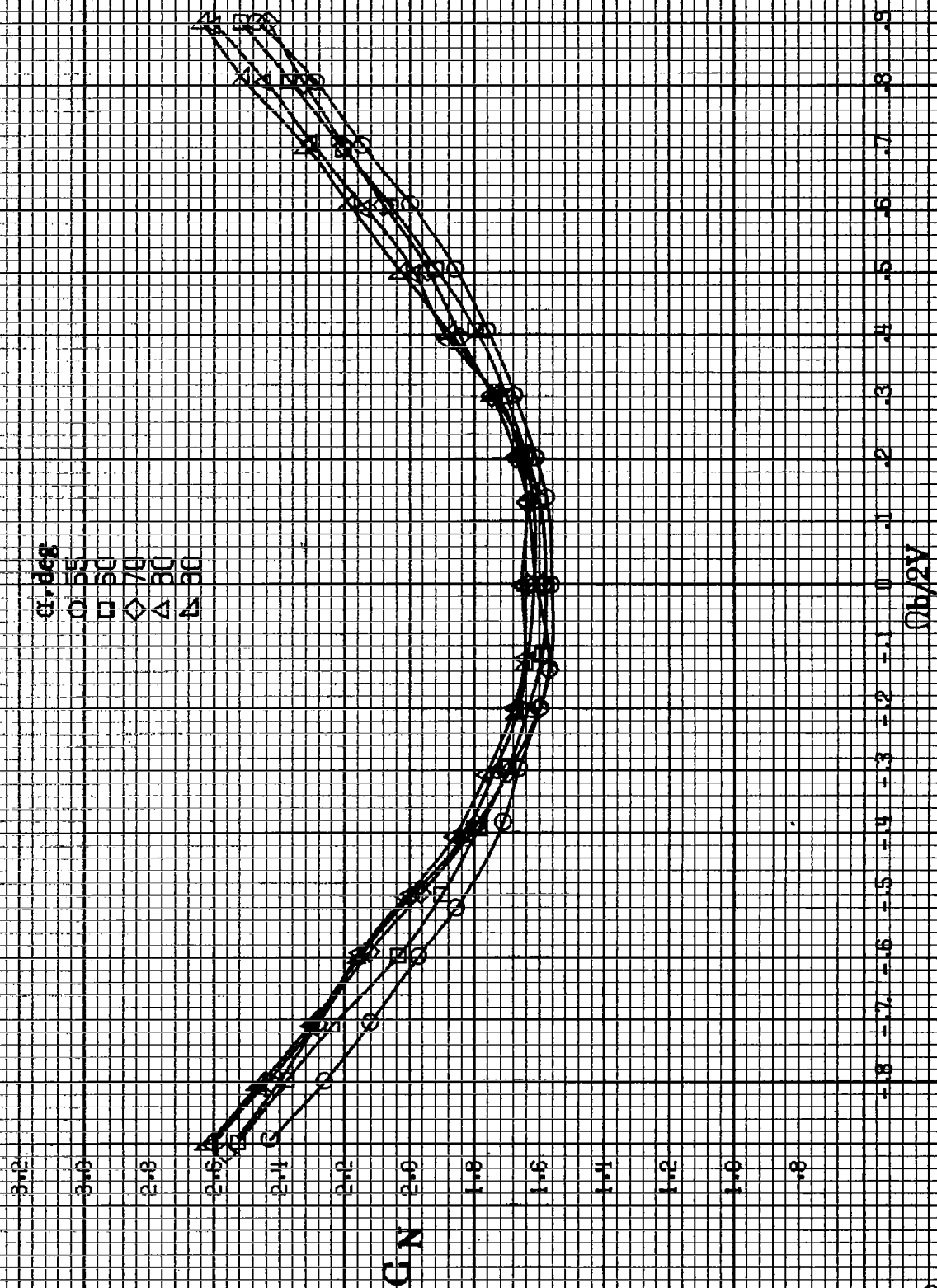
(a)  $\alpha = 8$  (0.16 deg),  $SR = 182.9$  cm (72 in).  
 Figure A-160.-Effect of variation in angle of attack on normal force coefficient for configurations having semi-struts, full fillets and emergency spin chute installation.  $\alpha$ , -8 to 9;  $C_N$ , 0 to 1.6.



(b)  $\mu=18055\text{deg}$ ,  $SR=182.9\text{cm}(72\text{in})$   
Figure A160, Continued.



(a)  $\alpha = 30$  to  $50^\circ$ ,  $SR = 0$ .  
Figure A160. Continued.



(d)  $n=55$  to  $90^\circ$ ,  $SR=0$ .  
Figure A100-Continued.

8660

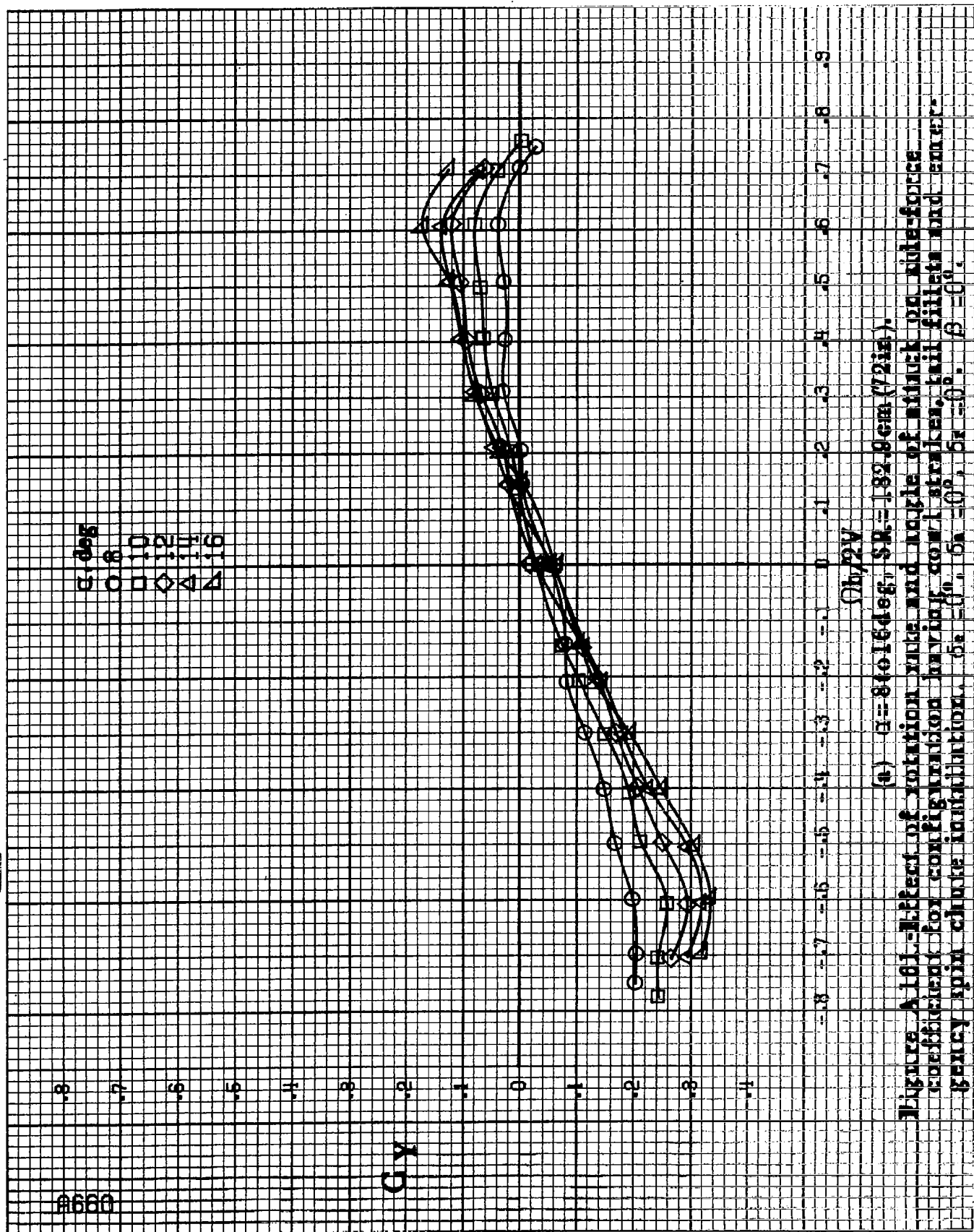
$\alpha$ , deg  
 0 8  
 10  
 12  
 14  
 16

$C_y$

$\Omega b / 2V$

(a)  $\alpha = 8$  to  $16$  deg,  $SR = 1.929$  cm (72 in).

Figure A161.-Effect of rotation rate and angle of attack on side-force coefficient for configuration having cow! strokes, tail fillets and emergency spin chute installation.  $\delta_a = 0^\circ$ ,  $\delta_r = 0^\circ$ ,  $\beta = 0^\circ$ .





72000  
50000  
30000  
10000

$C_{1/2}$

$C_{1/2}/2V$

(b)  $\mu = 1.8 \times 10^5 \text{ deg}$ ,  $SR = 1.829 \text{ cm} (72 \text{ in})$ ,  
Figure A.16.1. Continued.

B661

8662

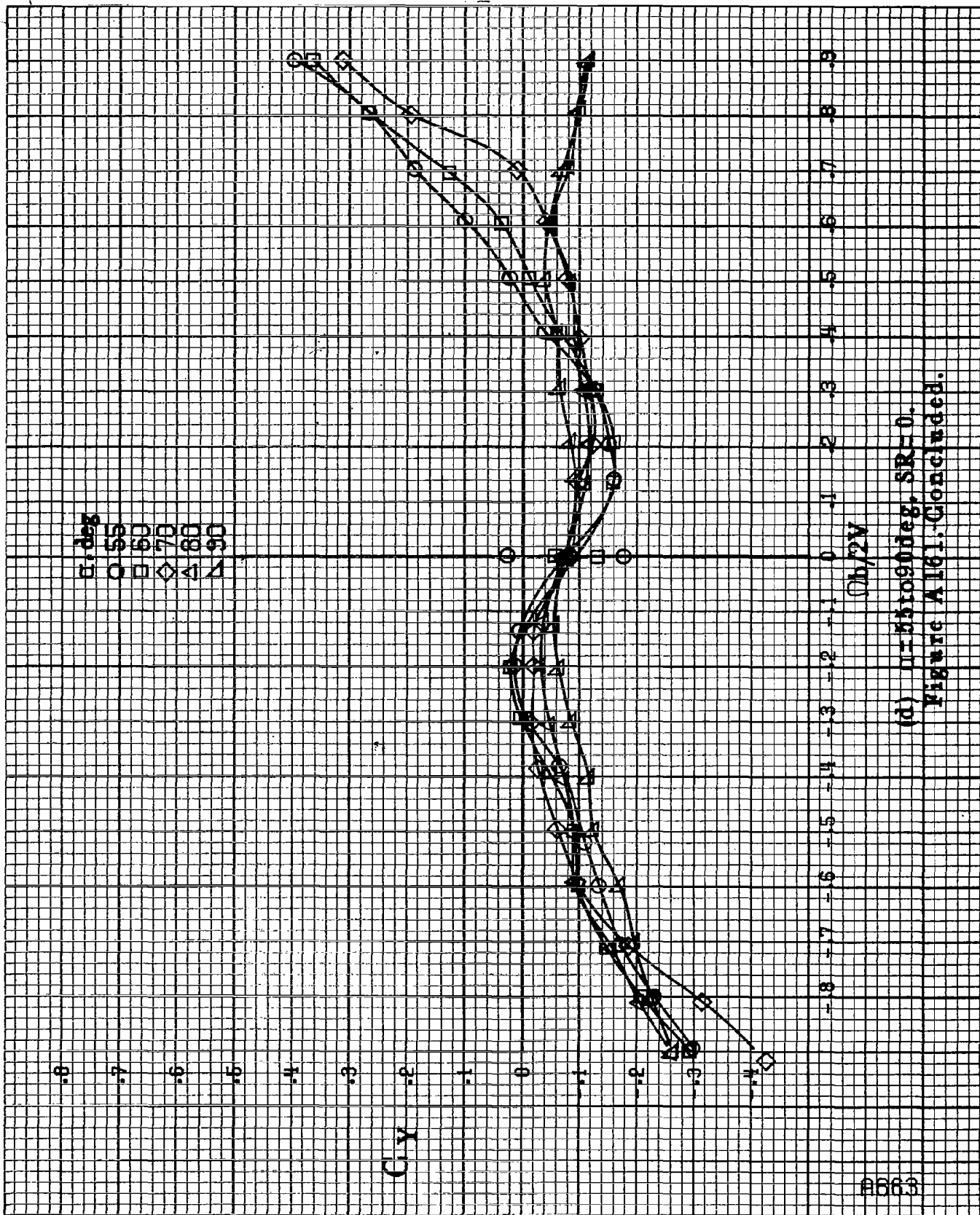
$\alpha$ , deg  
 ○ 30  
 □ 35  
 ◇ 40  
 △ 45

$C_Y$

$Ch/2V$

(c)  $D=50$  to  $500$  deg,  $SR=0$ .  
 Figure A161. Continued.





(d)  $\mu = 55$  to  $90^\circ$ ,  $SR = 0$ .  
Figure A161. Concluded.

#664

$\beta$ , deg

○ 8  
□ 10  
◇ 12  
△ 14  
▽ 16

$C_A$

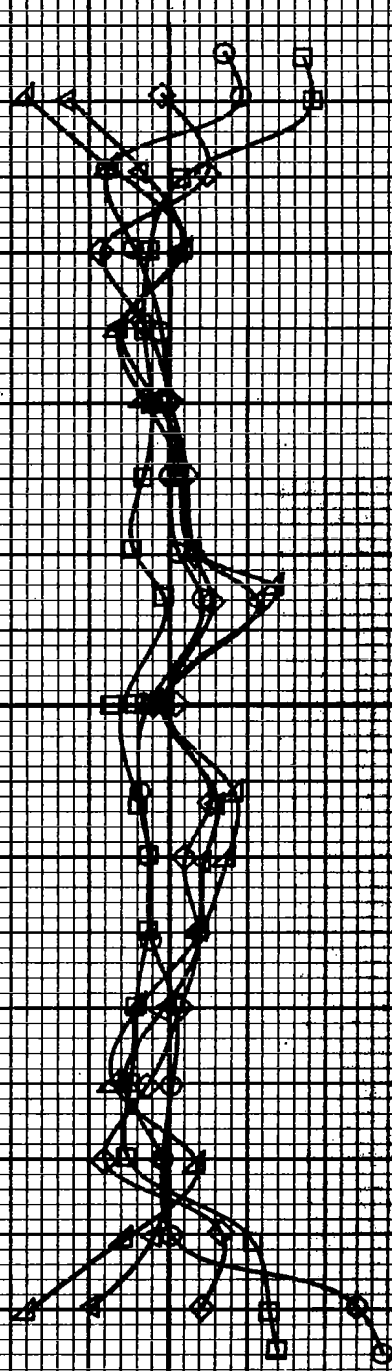
$\Omega h/2\pi$

(a)  $\alpha = 84$  to  $164$  deg,  $SR = 182.8$  cm (72 in.).

Figure A182-Effect of rotation rate and angle of attack on resonance coefficient for configurations involving conical strakes, tail fillets and emergency spin circle boundaries.  $\delta_1 = 0^\circ$ ,  $\delta_2 = 60^\circ$ ,  $\delta_3 = 0^\circ$ .

GA

SR-162.9cm (72in)  
 O 13  
 □ 20  
 △ 25  
 ▲ 30  
 ▽ 35



Ob, 2V

(b) SR-162.9cm (72in).  
 Figure A162-Continued.

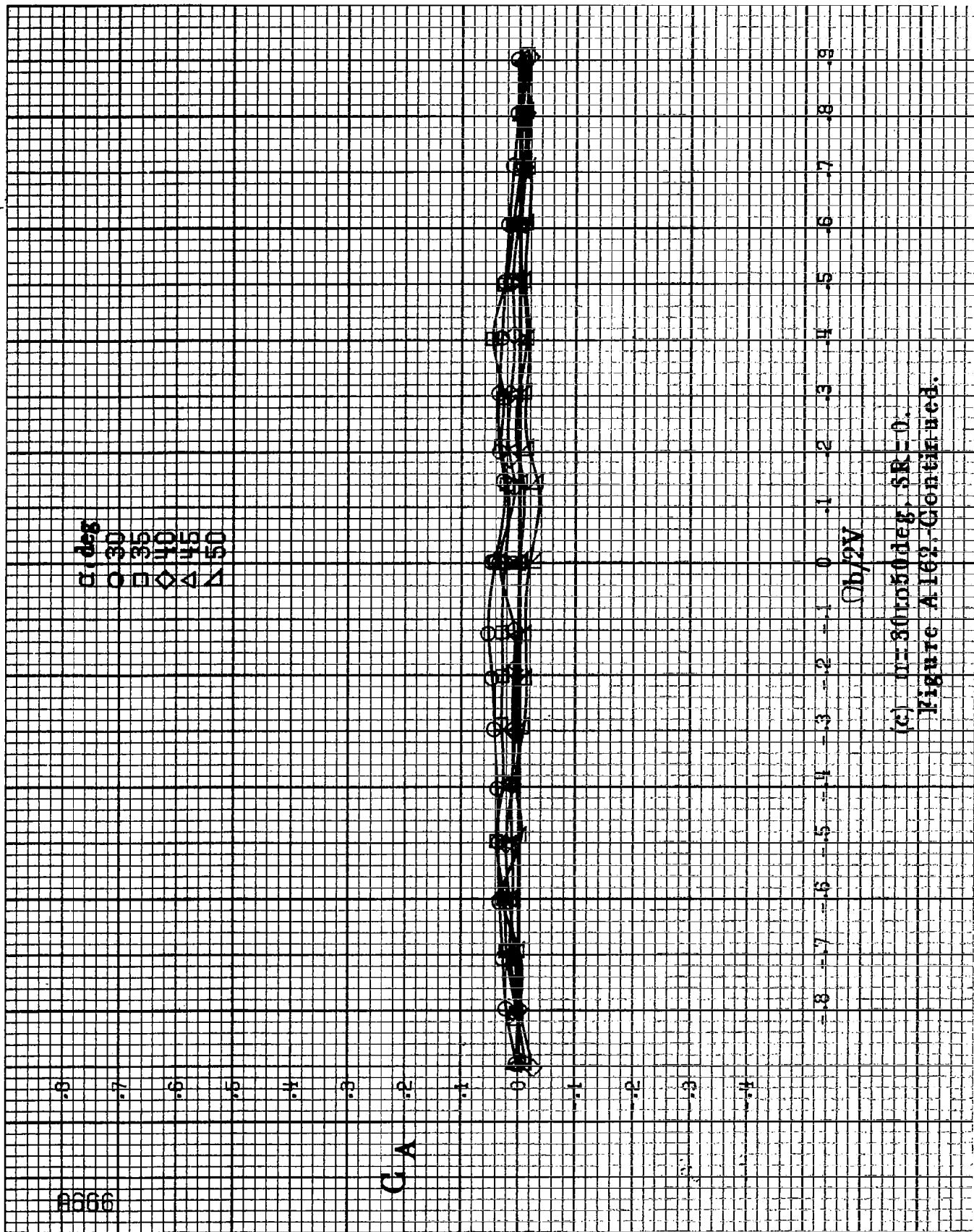
8366

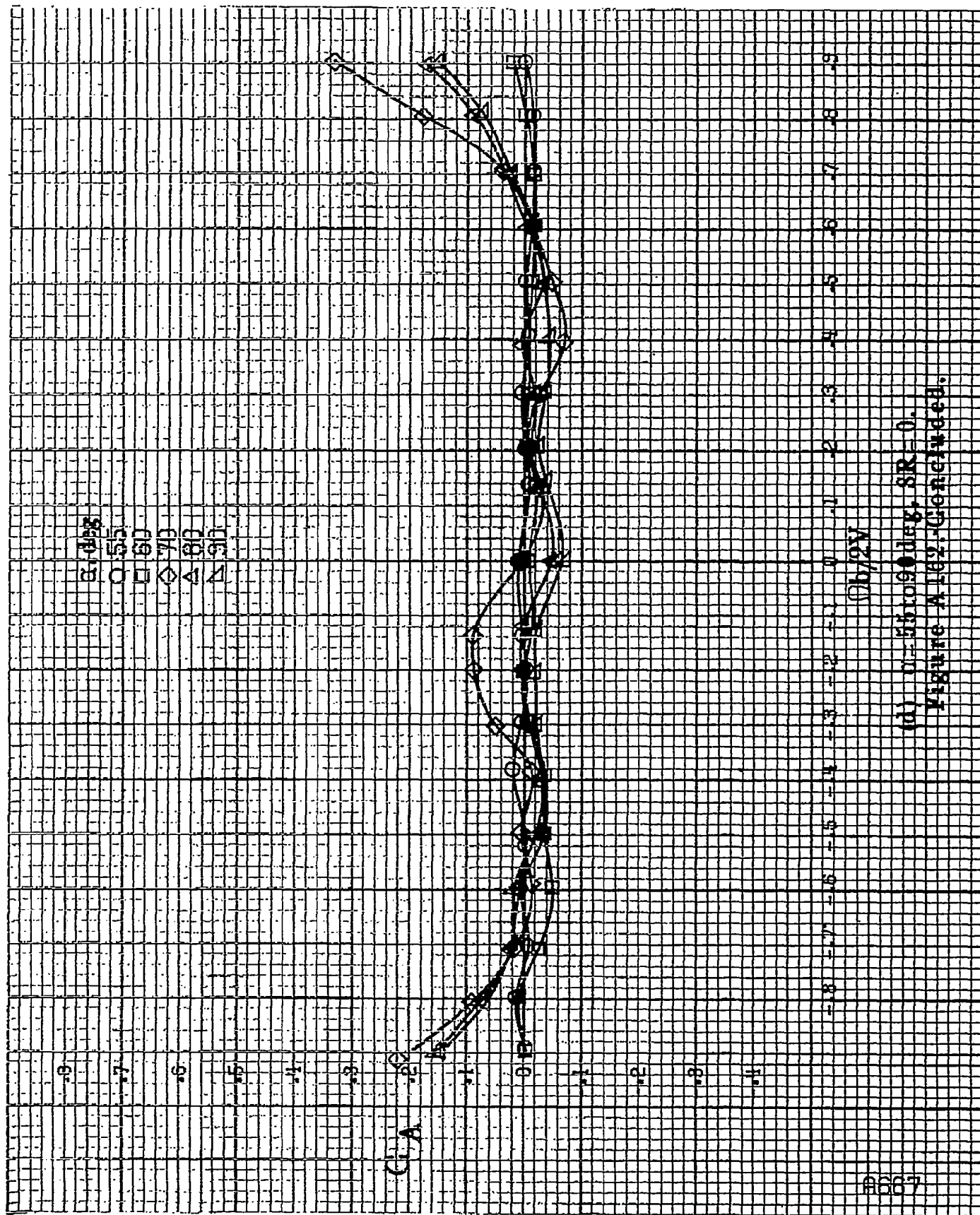
$\alpha$ , deg  
 O 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▲ 50

G A

$\phi_b/2V$

(c)  $\mu=30$  to 50 deg,  $SR=0$ .  
 Figure A162-Continued.

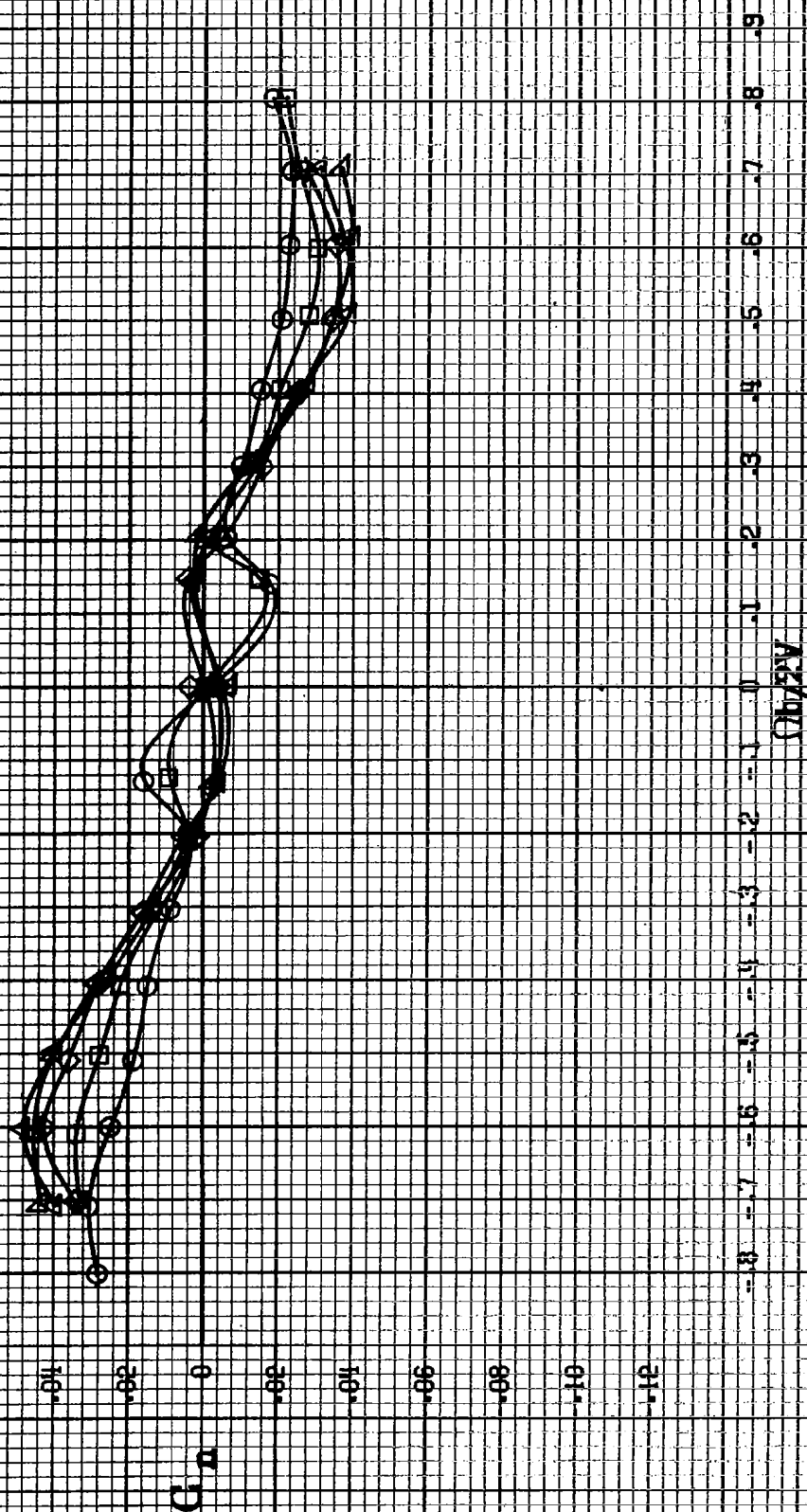




(d)  $N=55000$  deg,  $SR=0$ .  
Figure A102. Continued.

8668

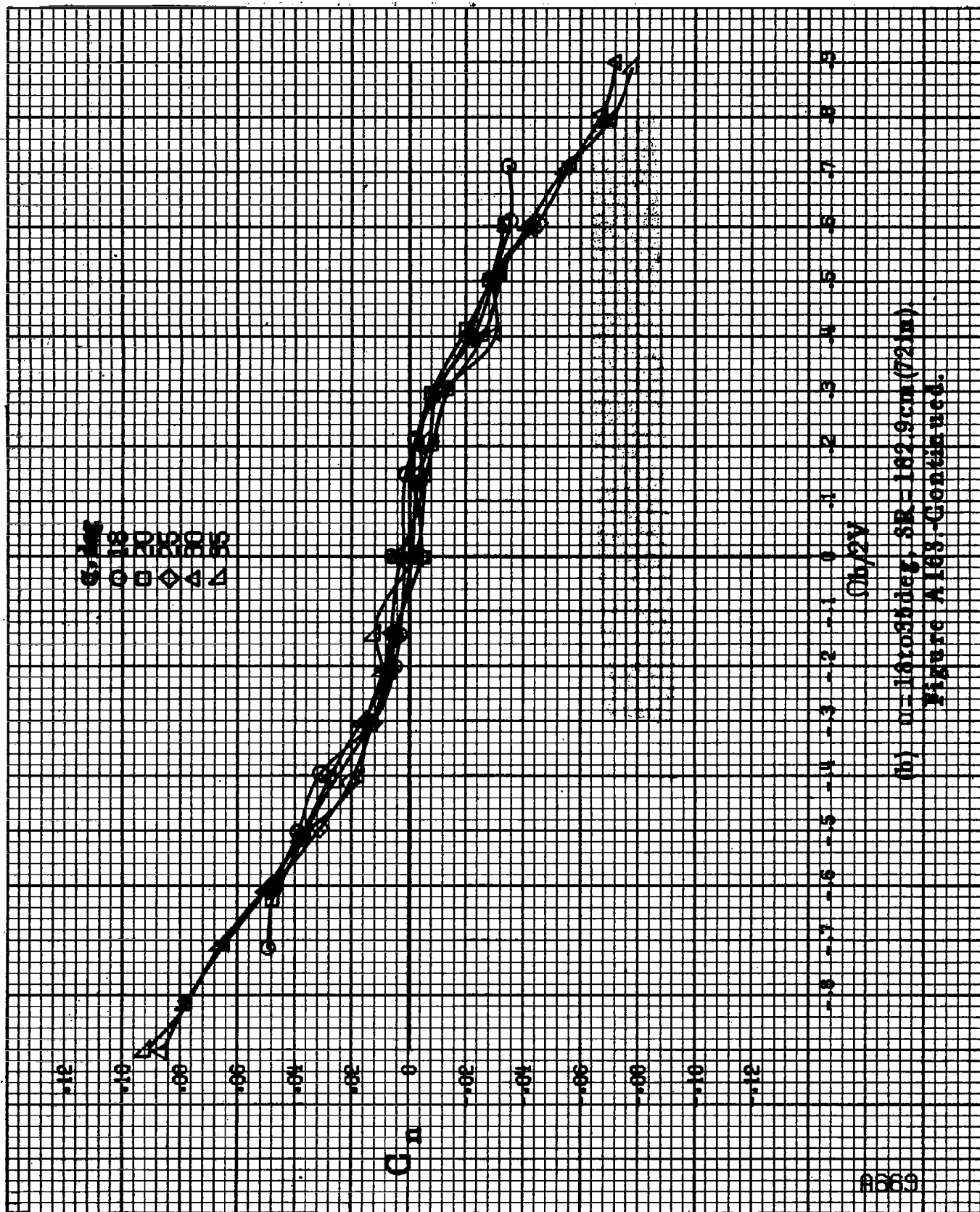
0.3deg  
 8  
 10  
 12  
 14  
 16



(a)  $\alpha = 8401648g$ ,  $SR = 132.9cm(72in)$ .

Figure A-168.-Effect of rotation rate and angle of attack on yawing-moment coefficient for configuration having cow strikes and tail fillets.  $\beta = 0^\circ$ ,  $\delta_A = 0^\circ$ ,  $\delta_T = 0^\circ$ ,  $\beta = 0^\circ$ .



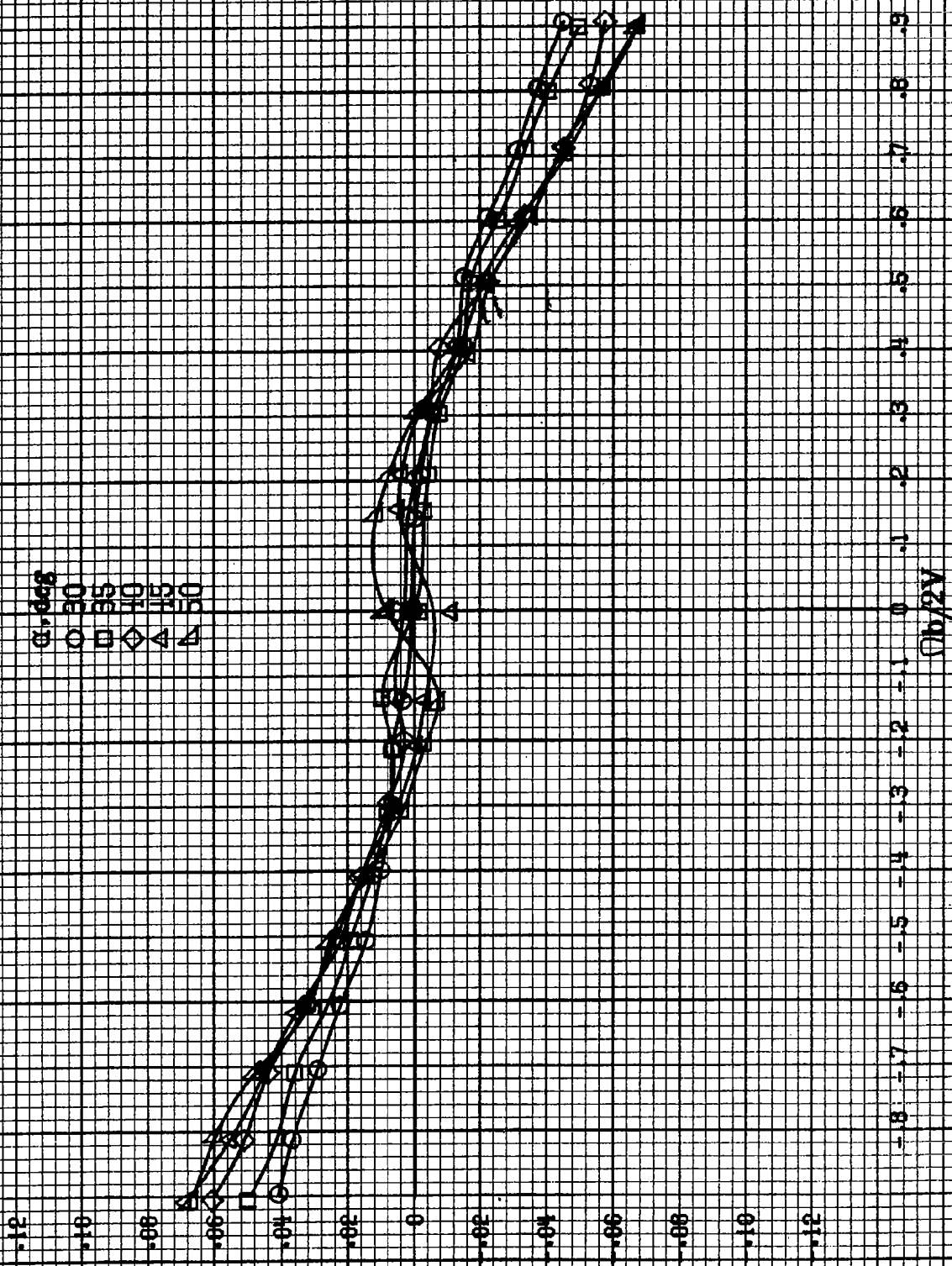


(b)  $\mu=161035$ deg, SR-182.9cm (72in).

Figure A183-Continued.

8670

0.308  
0.30  
0.35  
0.40  
0.45  
0.50



(c)  $\mu = 80 \text{ to } 80 \text{ deg}$ ,  $SR = 0$ ,  
Figure A163-Continued.

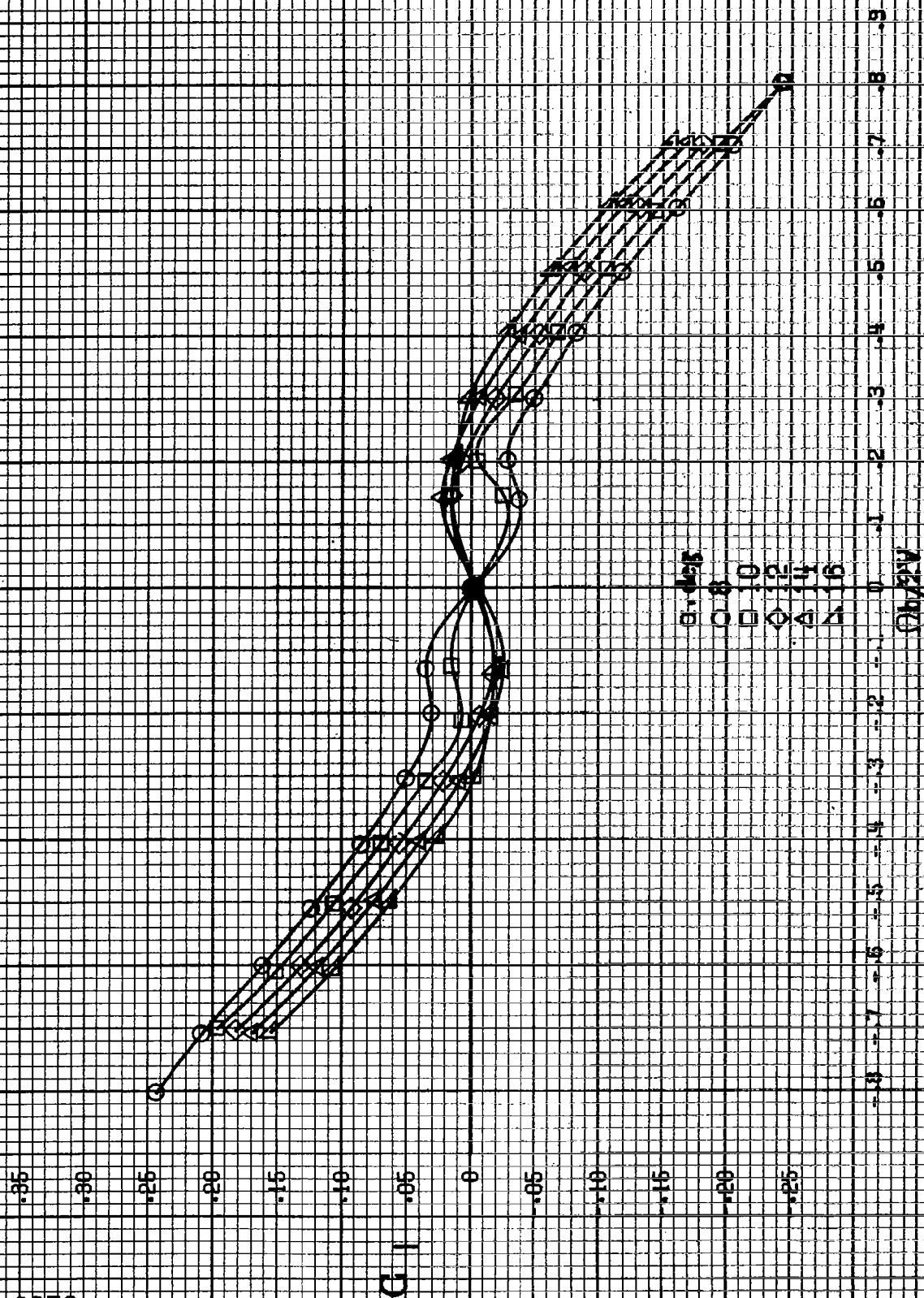
$\alpha$ , deg  
 55  
 60  
 65  
 70  
 75  
 80

$C_n$   
 .12  
 .10  
 .08  
 .06  
 .04  
 .02  
 0  
 .02  
 .04  
 .06  
 .08  
 .10  
 .12

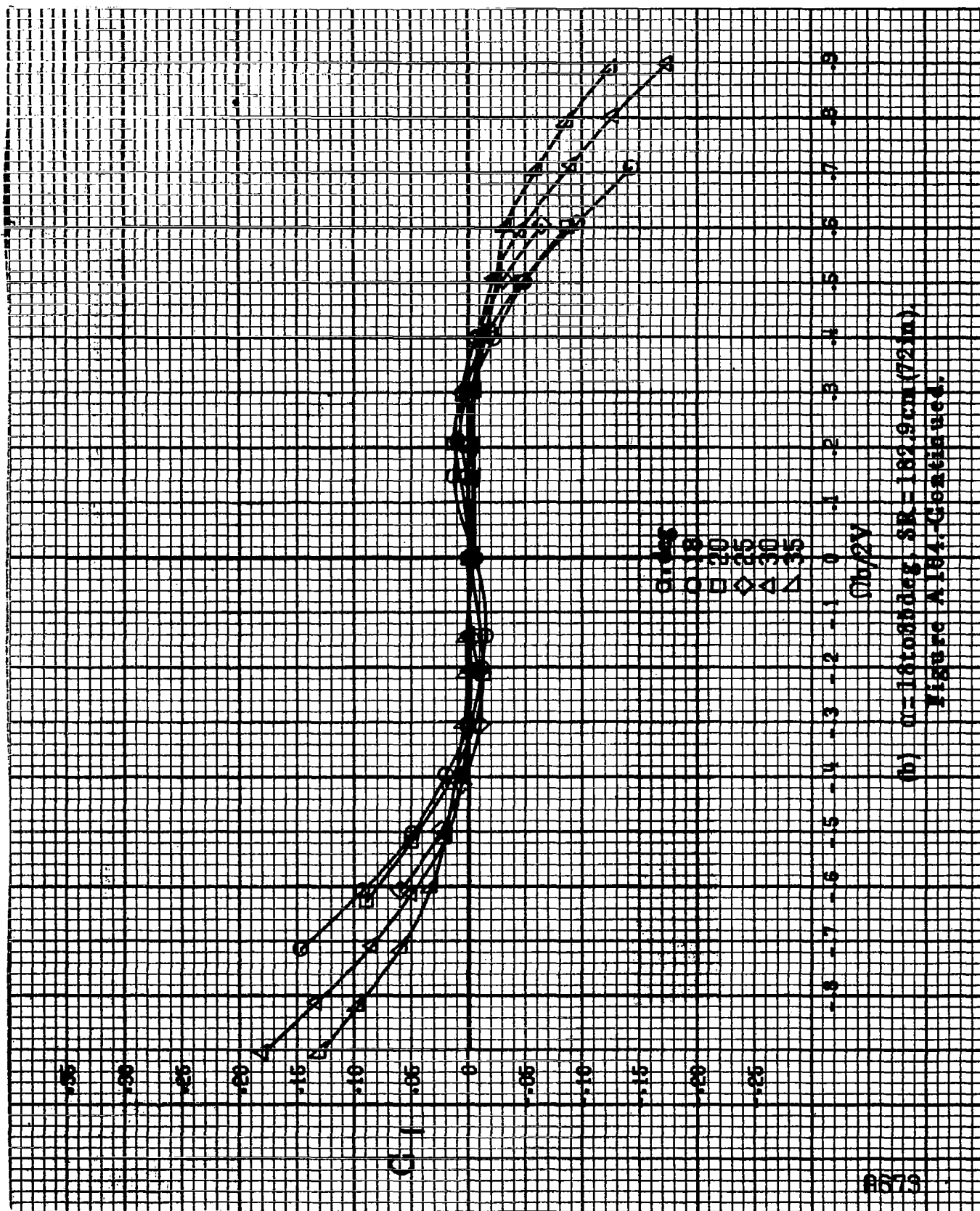
$\Omega b/2V$   
 .9  
 .8  
 .7  
 .6  
 .5  
 .4  
 .3  
 .2  
 .1  
 0  
 -.1  
 -.2  
 -.3  
 -.4  
 -.5  
 -.6  
 -.7  
 -.8  
 -.9

(d)  $\omega = 55090 \text{ deg}$ ,  $SR = 0$ .  
 Figure A168-Concluded.

8672



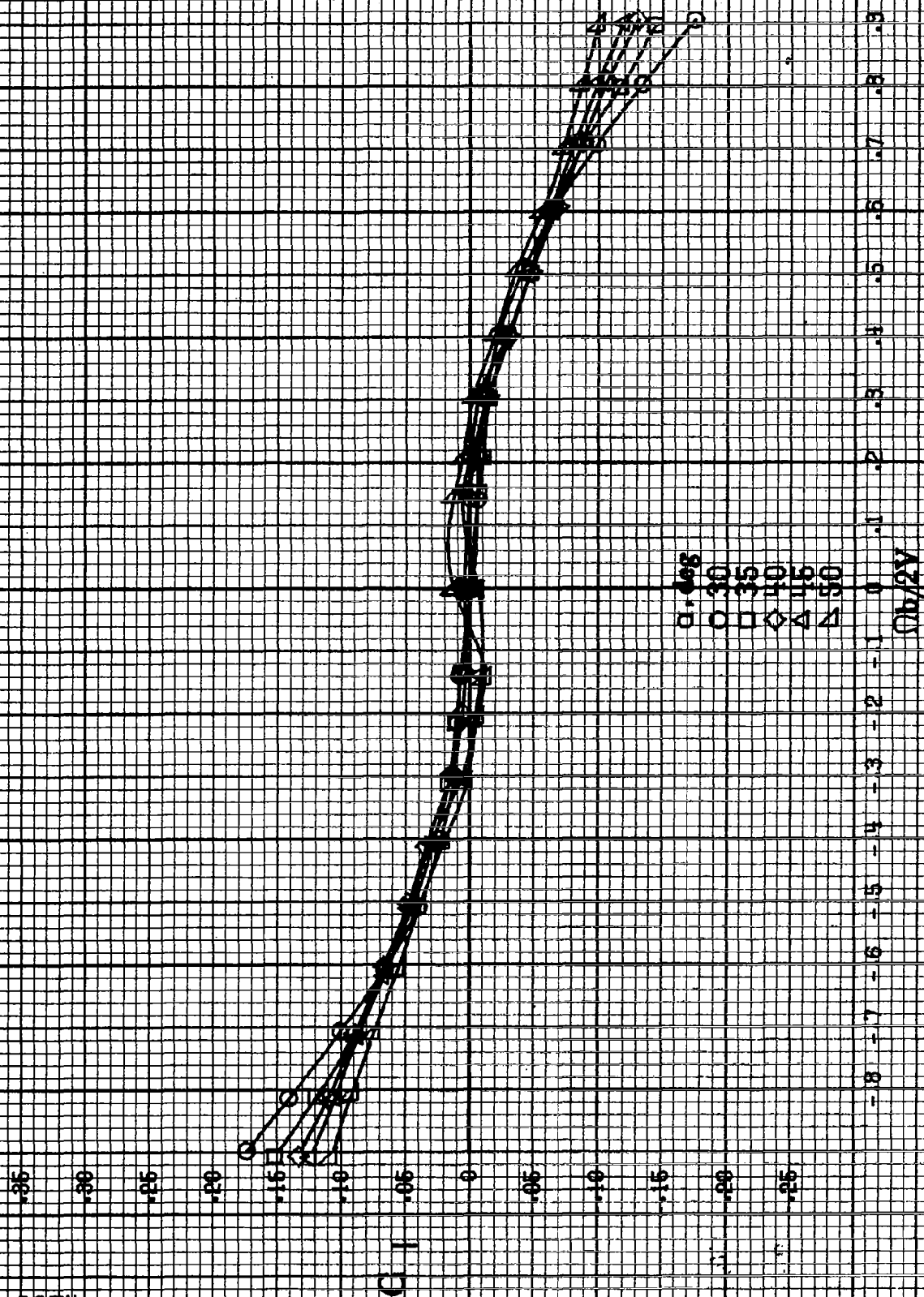
(a)  $\alpha = 8, 10, 12, 14, 16^\circ$ ;  $RR = 182.8 \text{ cm} (72 \text{ in})$ .  
 Figure A184: Effect of rotation speed and angle of attack on rolling-moment coefficient for configuration-fillet cant strakes and tail fillers.  $\beta = 0^\circ$ ,  $\delta = 0^\circ$ ,  $\epsilon = 0^\circ$ ,  $\theta = 0^\circ$ .



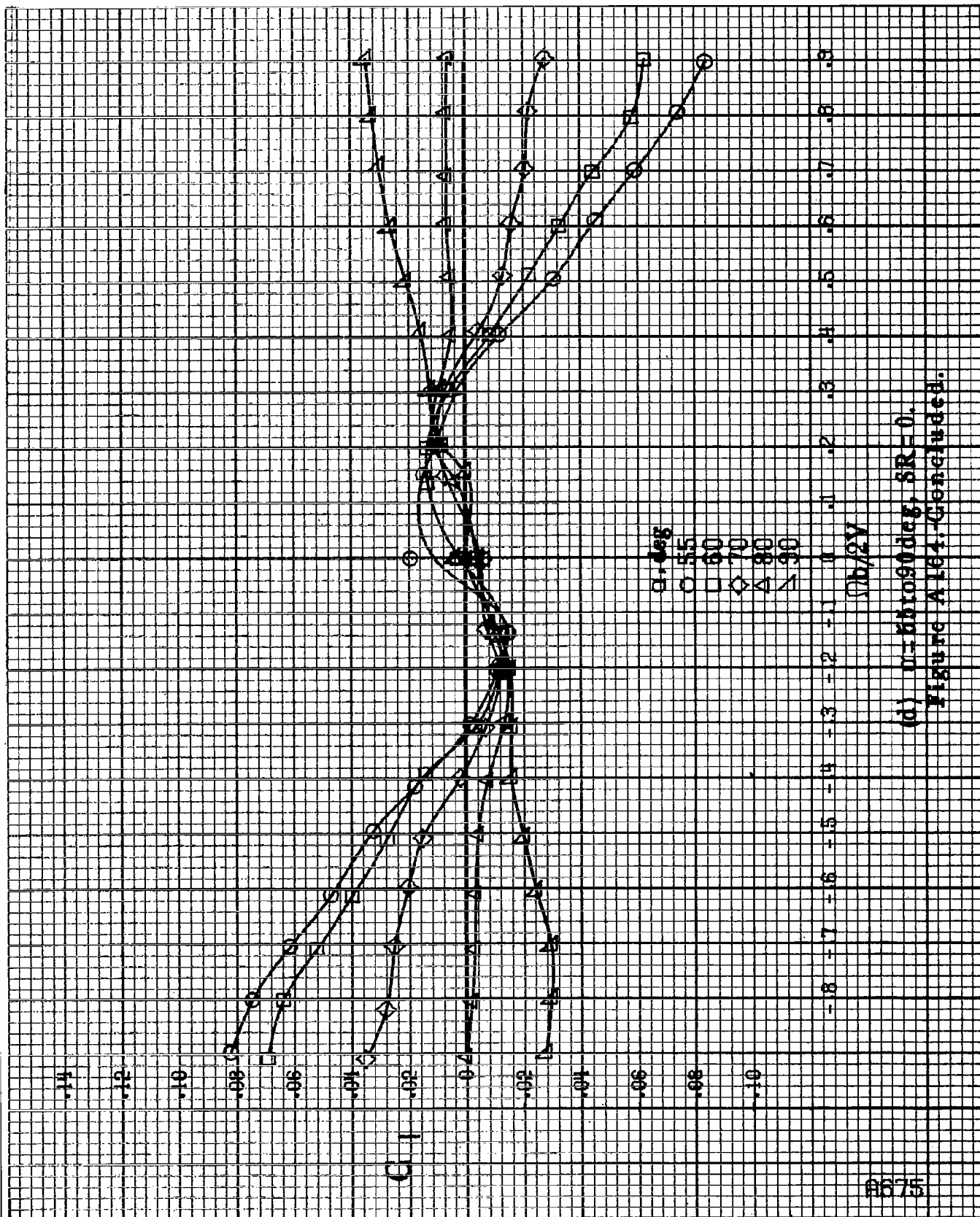
(b)  $\alpha = 16$  to  $88$  deg,  $SR = 182.9$  cm (72 in).

Figure A184-Continued.

8674



(c)  $\eta = 86$  to  $00$  deg,  $SR = 0$ .  
Figure A164-Continued.



(d)  $\alpha=85$  to  $90$  deg,  $\delta R=0$ .  
Figure A161-Continued.

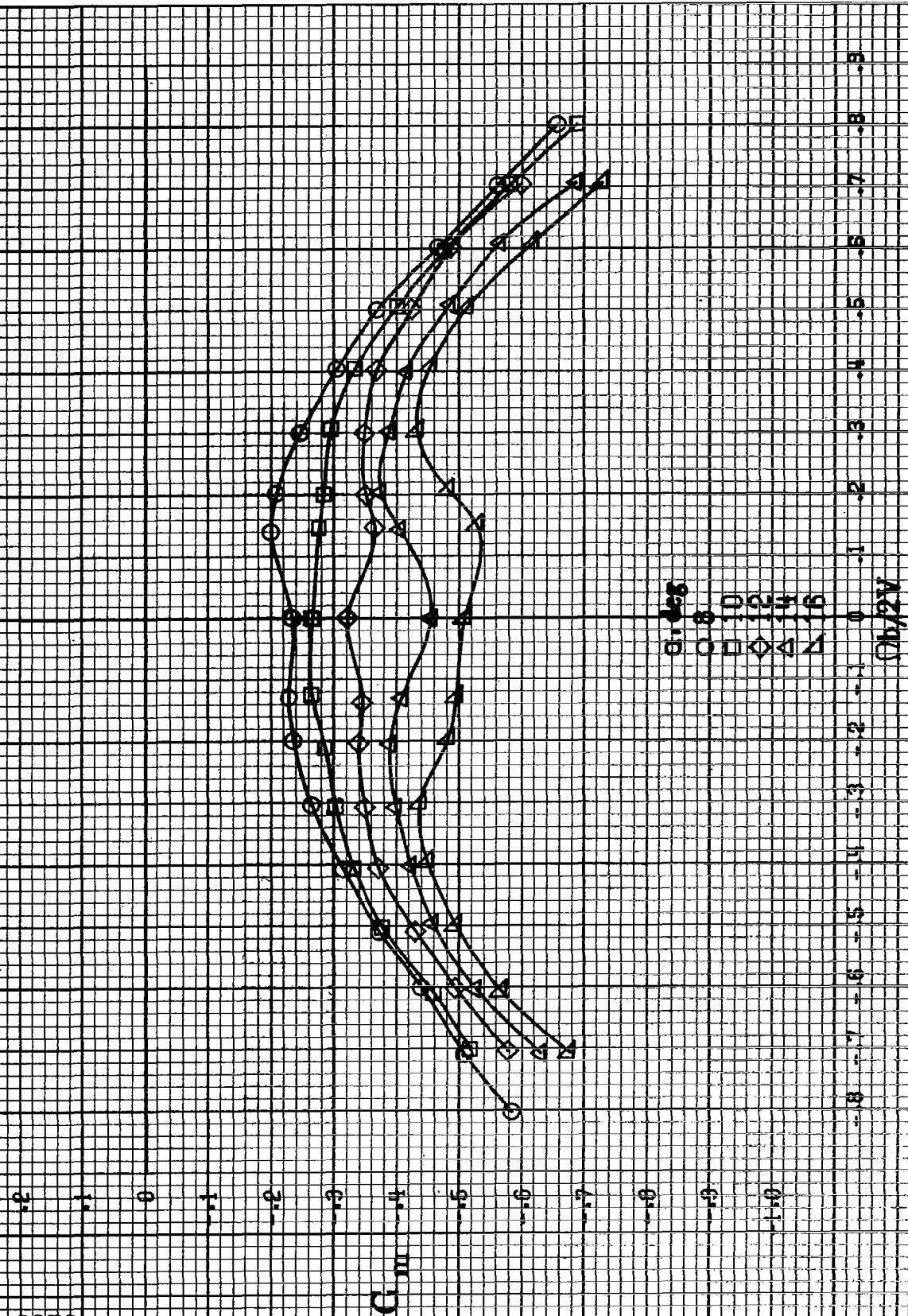


Figure A188. Effect of rotation rate and angle of attack on pitching-moment coefficient for configuration having cowl strakes and tail fillets.  $\delta = 10^\circ$ ,  $\delta_s = 10^\circ$ ,  $\delta_t = 10^\circ$ .



1.2

1.1

1.0

0.9

0.8

0.7

0.6

0.5

0.4

0.3

0.2

0.1

0.0

-0.1

-0.2

-0.3

-0.4

1.2

1.1

1.0

0.9

0.8

0.7

0.6

0.5

0.4

0.3

0.2

0.1

0.0

-0.1

-0.2

-0.3

-0.4

$C_{1m}$

$B = 0.05$

$\circ 18$

$\square 20$

$\diamond 25$

$\triangle 30$

$\nabla 35$

$\phi b/2V$

(b)  $\alpha = 16.08 \text{ deg}$ ,  $SR = 182.9 \text{ cm}$  (72 in).

Figure A165-Continued.

A677

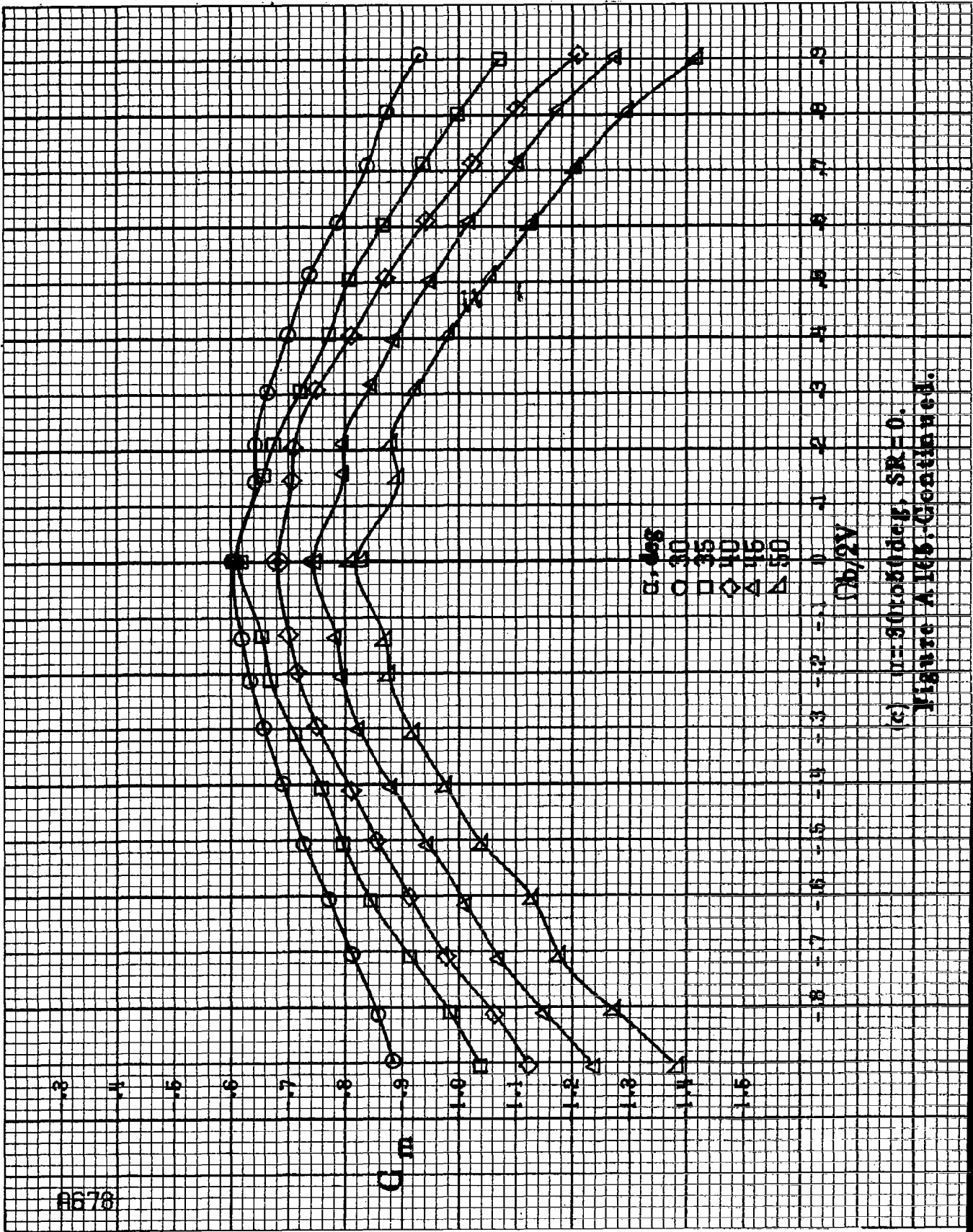
B678

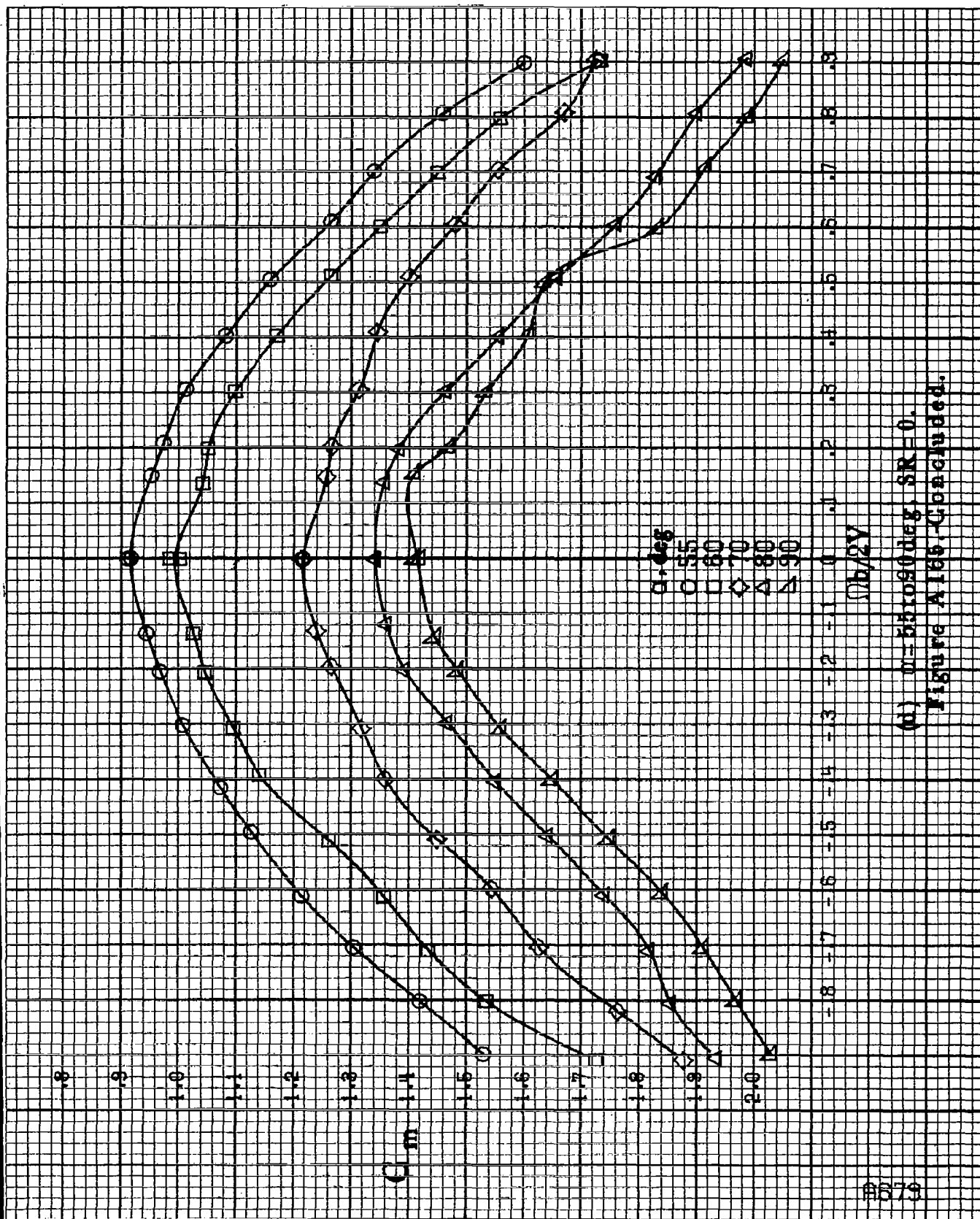
$G_m$

$\theta, \text{deg}$   
 ○ 30  
 □ 35  
 ◇ 40  
 △ 45  
 ▴ 50

$V_b, \text{V}$

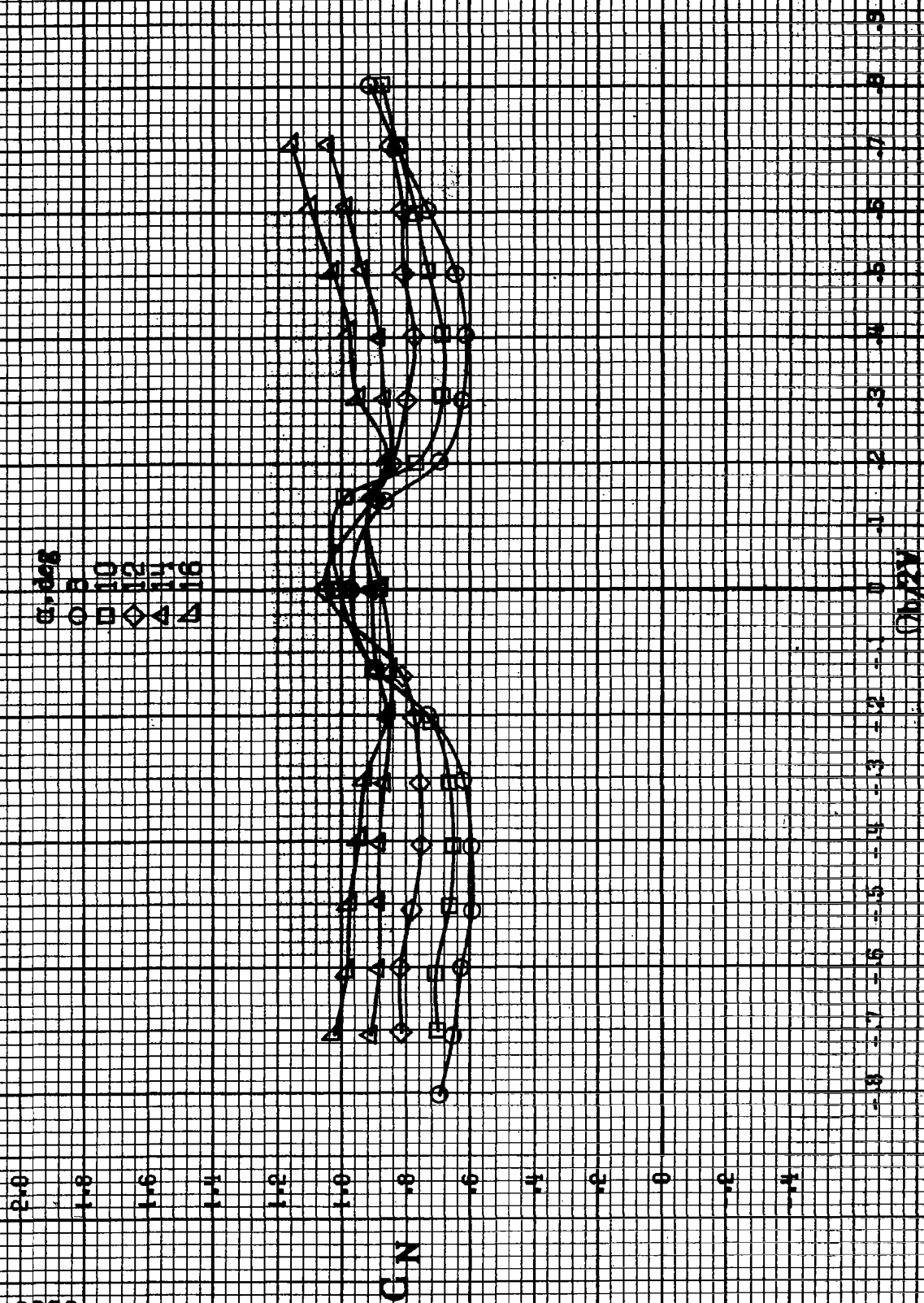
(c)  $\eta = 90 \text{ (rad/deg)}, SR = 0$ .  
 Figure A.16b. Continued.



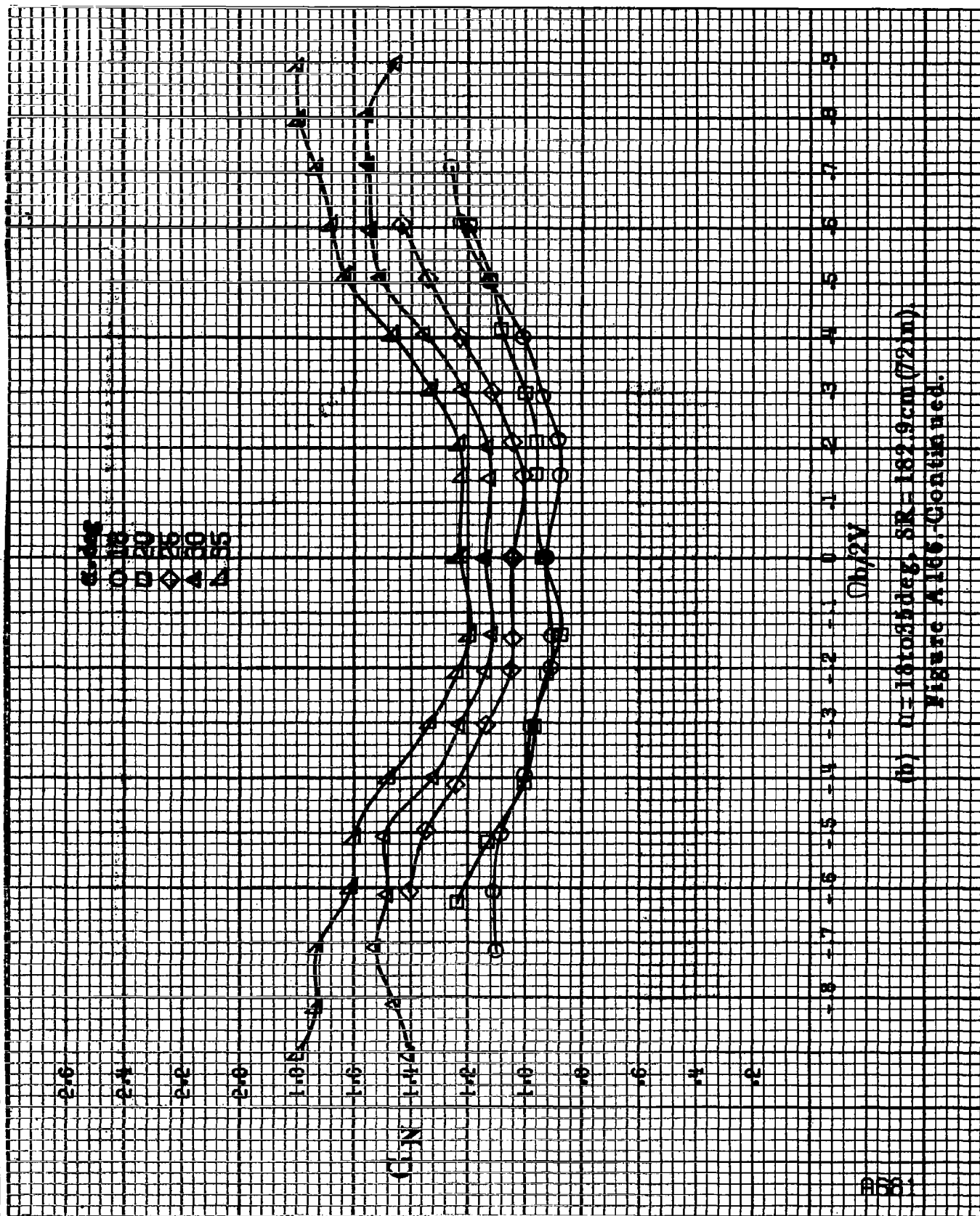


(d)  $\alpha = 55$  to  $90$  deg,  $SR = 0$ .  
Figure A165. Continued.

8680



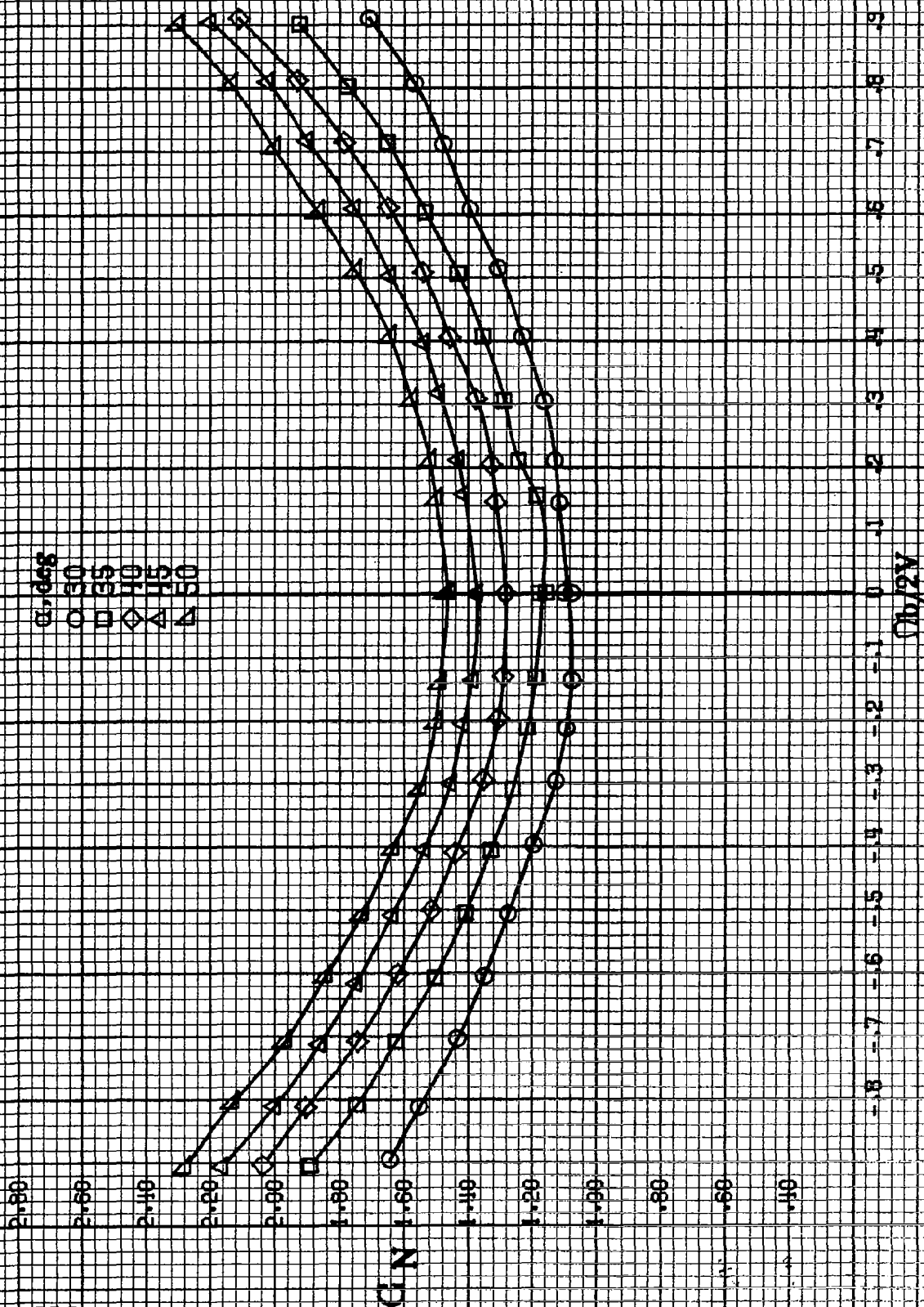
(a)  $\alpha = 8(0.164 \text{ deg})$ ,  $SR = 132.8 \text{ cm} (7.2 \text{ in})$ .  
Figure A186.-Effect of rotation rate and angle of attack on normal-force coefficient for configurations having cowli strikes and tail finlets.  $\delta = 0^\circ$ ,  $\delta_s = 0^\circ$ ,  $\delta_r = 0^\circ$ ,  $\delta = 0^\circ$ .



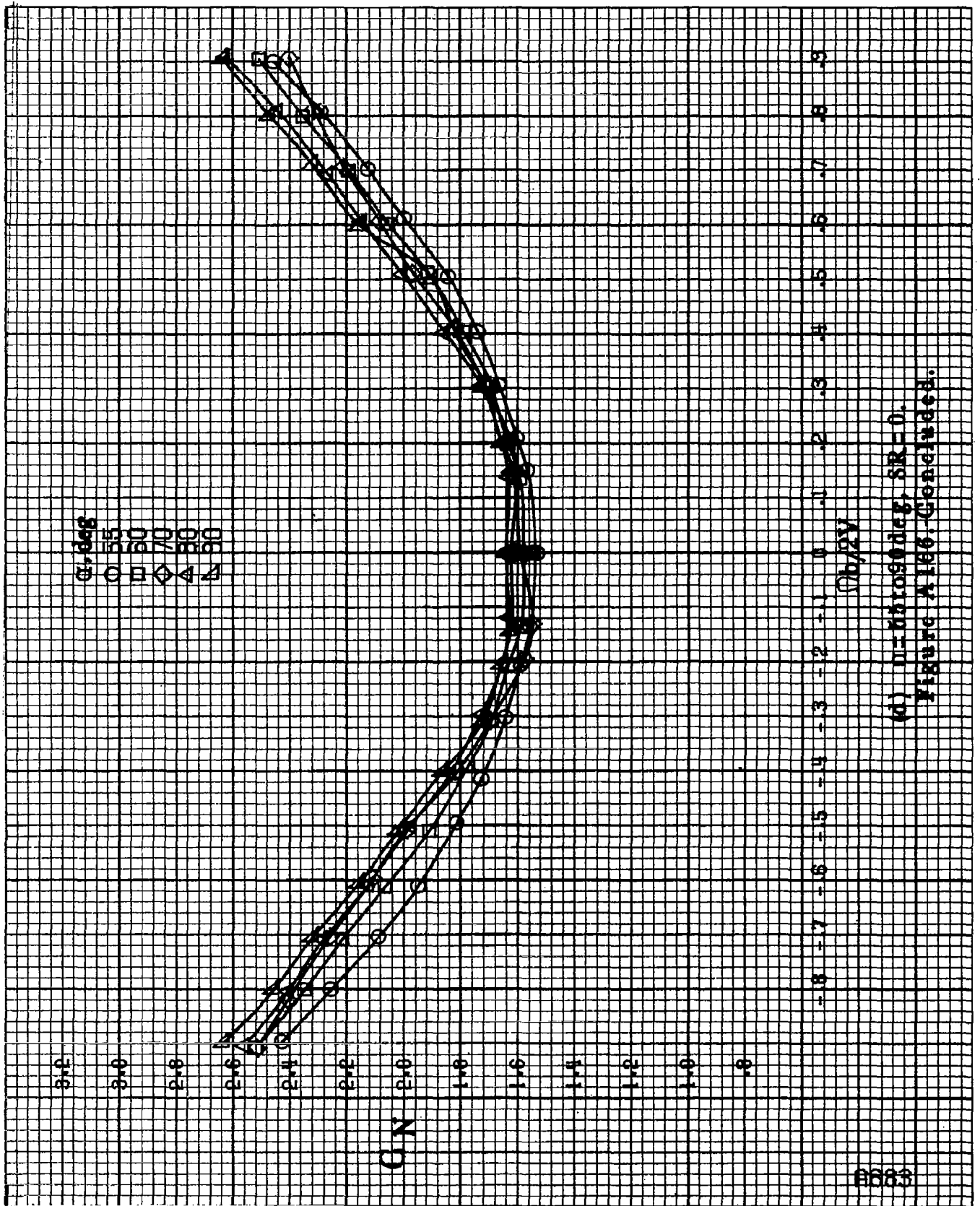
(b)  $\eta = 181055 \text{ deg}$ ,  $SR = 182.9 \text{ cm} (72 \text{ in})$

Figure A186-Continued.

B602



(c)  $\mu = 80 \text{ ro/deg}$ ,  $SR = 0$ .  
Figure A166. Continued.



(d)  $\alpha = 80^\circ$ ,  $SR = 0$ .  
Figure A166. Continued.

8684

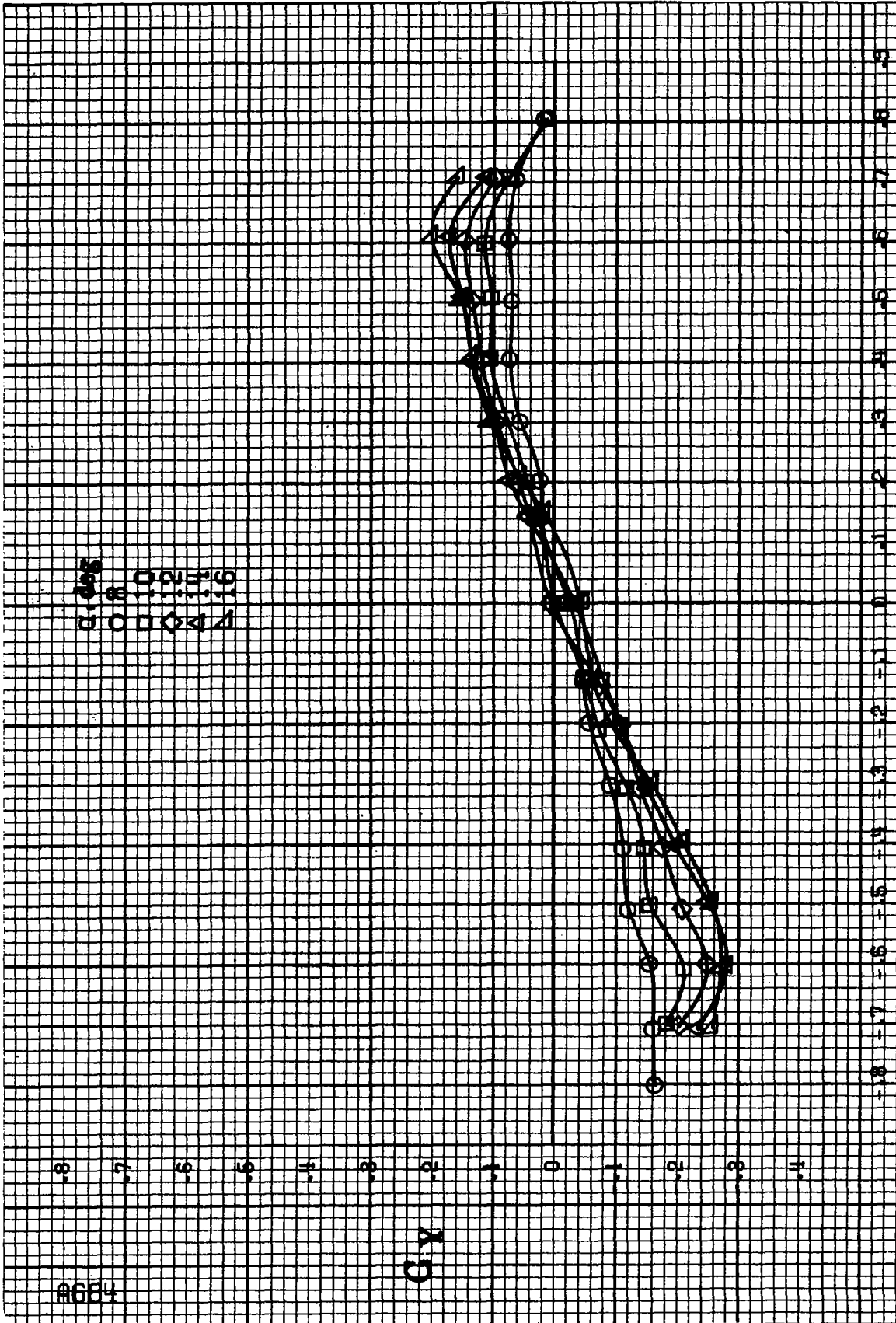
$\alpha, \text{deg}$   
 0 2 4 6 8 10 12 14 16

Cy

$b/2V$

(a)  $\alpha = 8.1$  to  $16.4 \text{ deg}$ ,  $SR = 1.89$  to  $2.00$  (72 in)

Figure A187-Effect of rotation rate and angle of attack on side-force coefficient for configuration having cowl strakes and tail fillets.  $\delta_a = 0^\circ$ ,  $\delta_r = 0^\circ$ ,  $\beta = 0^\circ$ .





5.18  
 5.10  
 5.05  
 5.00  
 4.95  
 4.90

$G \gamma$

$(h/2V)$

(b)  $u = 118085 \text{ deg}$ ,  $SR = 162.9 \text{ cm}$  (72.1 m)  
 Figure A167. Continued.

A685

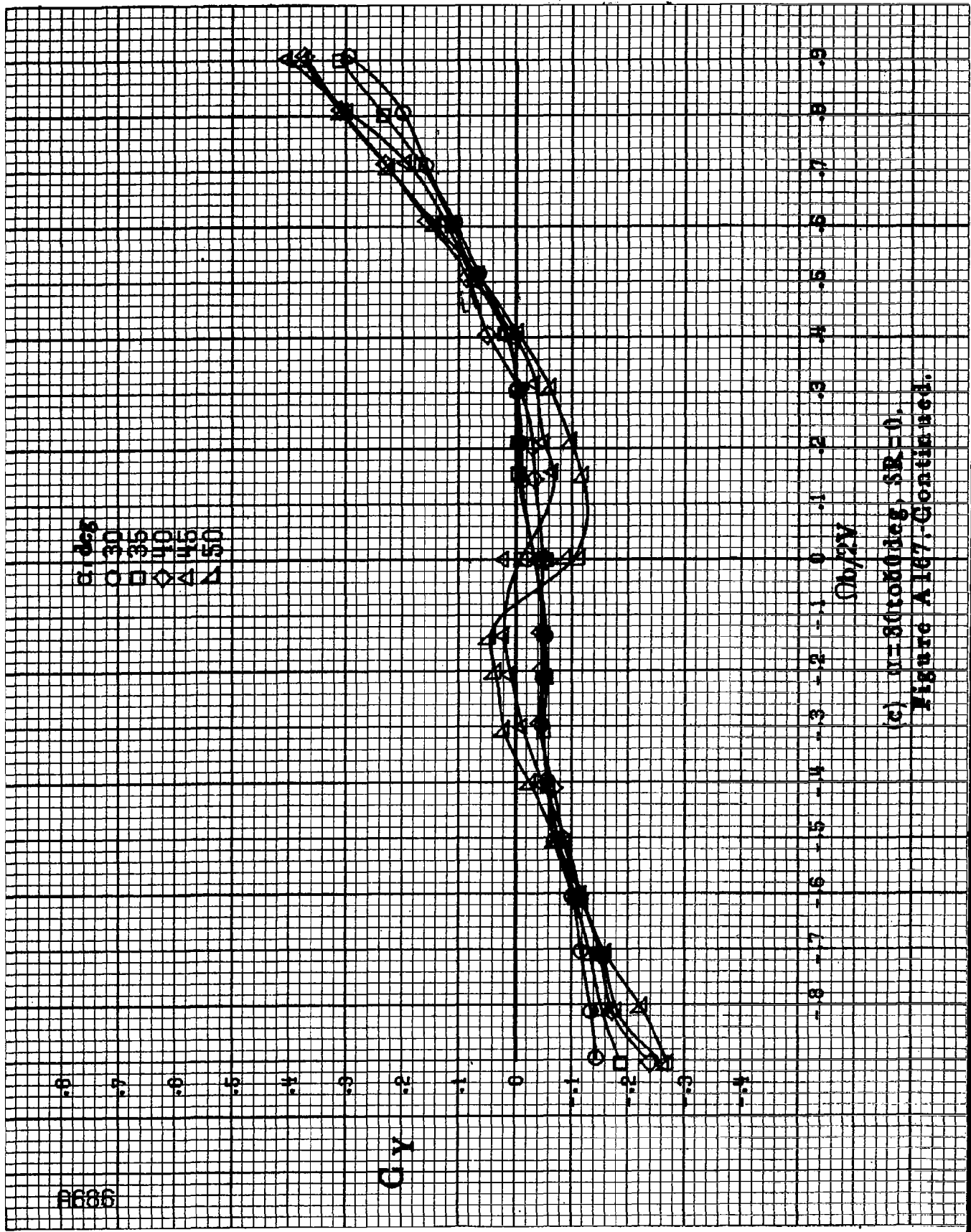
8686

$\alpha, \text{deg}$   
 $\circ 30$   
 $\square 35$   
 $\diamond 40$   
 $\triangle 45$   
 $\nabla 50$

$C_Y$

$\alpha_b/2V$

(c)  $\mu=30 \text{rodddeg}$ ,  $SR=0$ .  
 Figure A167. Continued.



$\phi$ , deg  
 ○ 55  
 □ 60  
 ◇ 70  
 △ 80  
 ▽ 90

$C/Y$

$Ob/2V$

(d) nitrated, SR=0.  
 Figure A167-Continued.

#567

8668

CA

5.0  
4.0  
3.0  
2.0  
1.0  
0.0  
-1.0  
-2.0  
-3.0  
-4.0  
-5.0

-8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8

0.2V

(a)  $\alpha = 84.16436$ ,  $\beta = 132.8677212$ .

Figure A.166. Effect of rotation rate and angle of attack on coefficients for configurations having cowi strokes and tail fillets.  $\delta = 0^\circ$ ,  $\delta = 0^\circ$ ,  $\beta = 0^\circ$ .

$\theta$ , deg  
 ○ 13  
 □ 20  
 ◇ 25  
 △ 30  
 ▴ 35

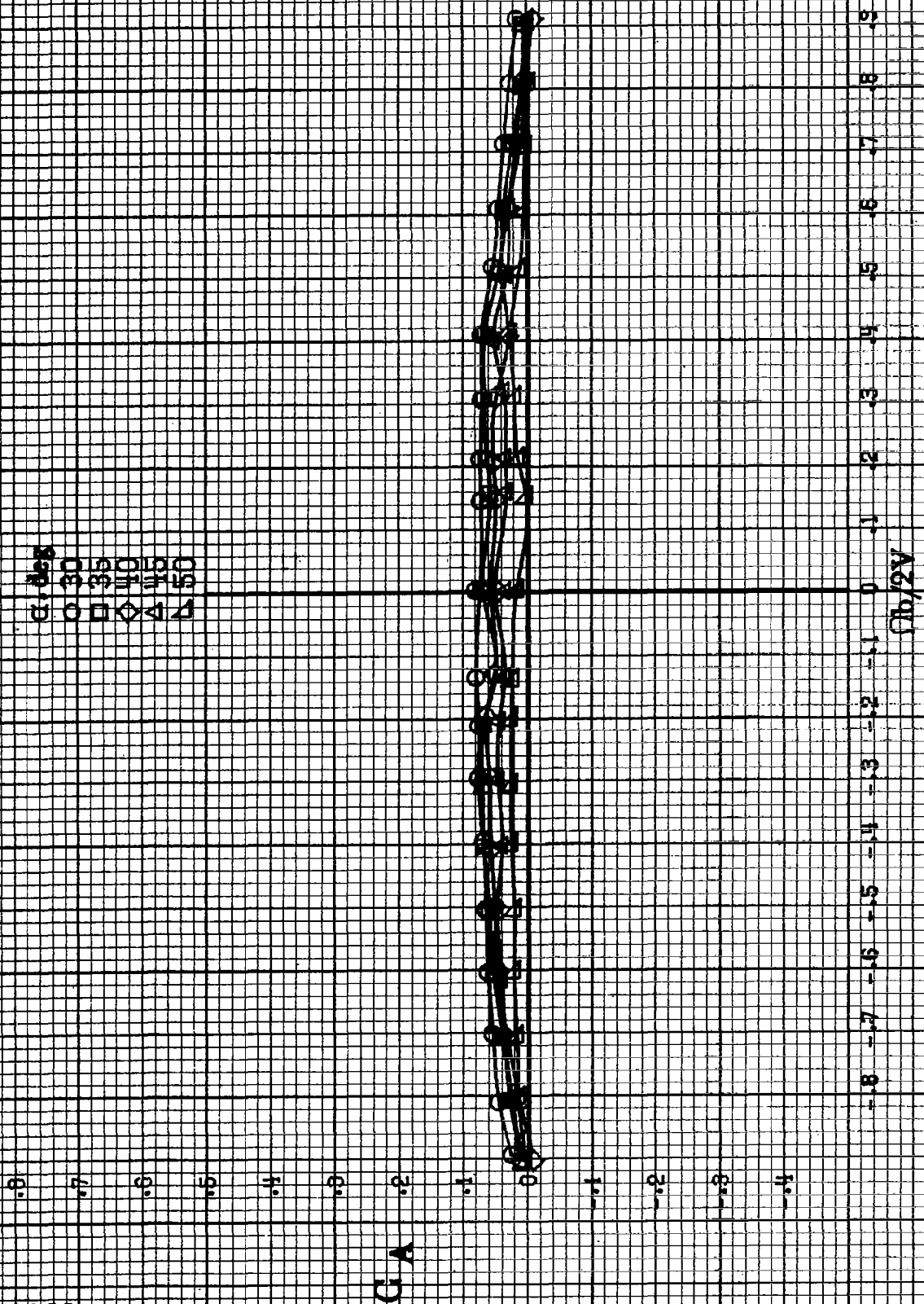
GA

$\phi_h/2V$

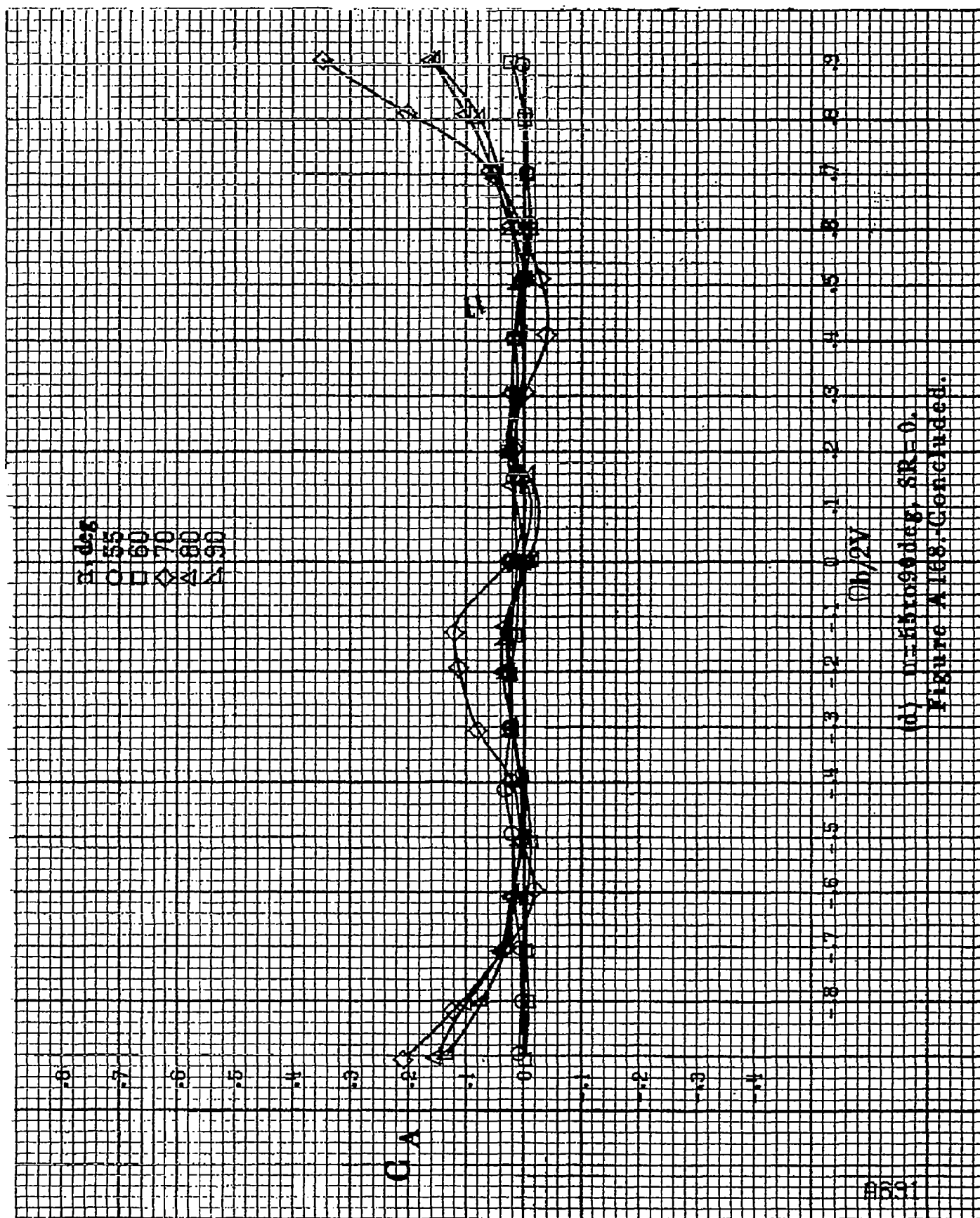
(b)  $\theta = 180.55$  deg,  $SR = 182.9$  cm (72 in).  
 Figure A168, Continued.

0000

RG90



(c)  $\alpha = 30$  to  $50^\circ$ ,  $SR = 0$ .  
Figure A168-Continued.



(d)  $n=55$  to  $90$  deg,  $SR=0$ .  
Figure A168-Concluded.



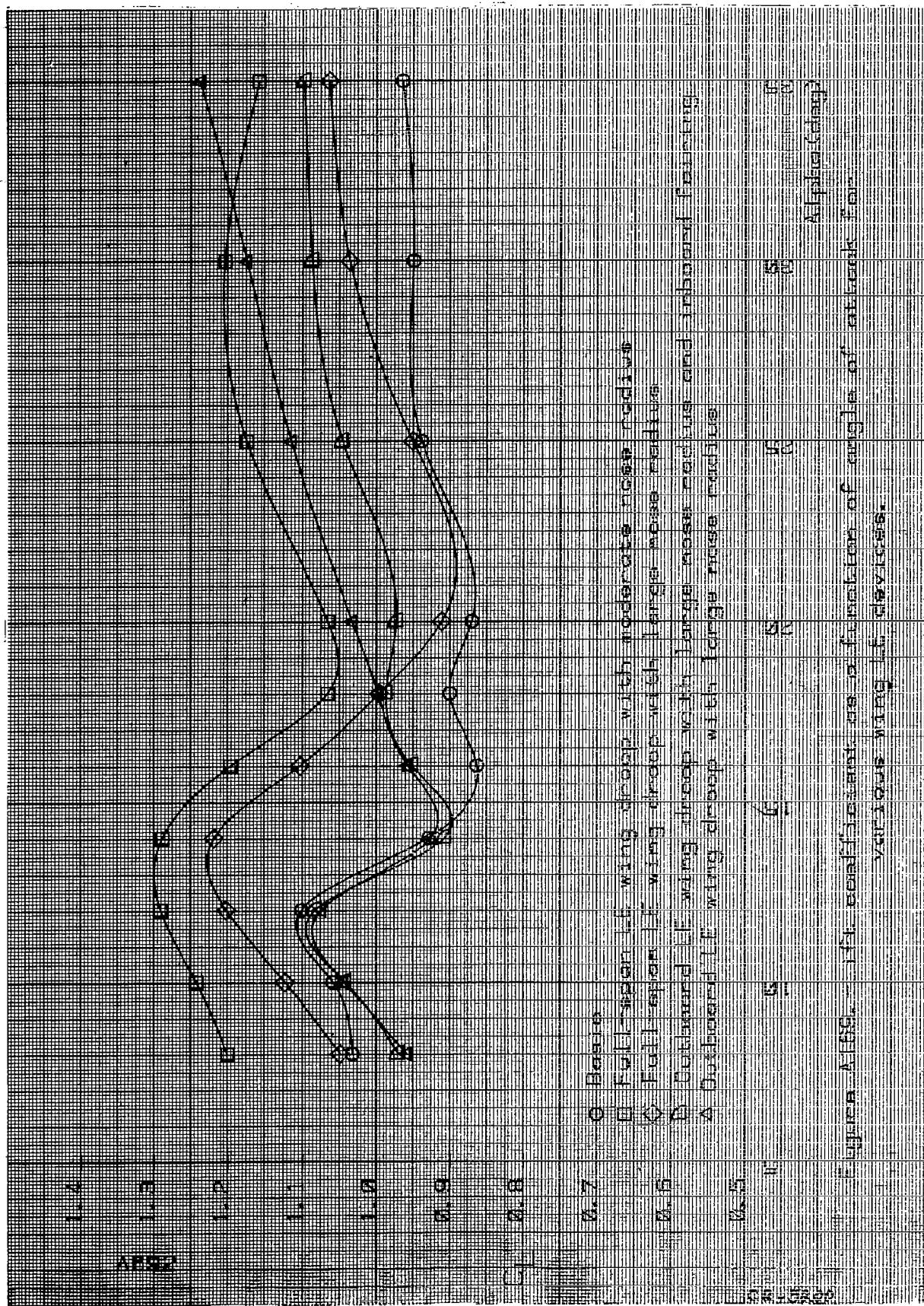


Figure A189.  $C_L$  coefficient as a function of angle of attack for various wing LE devices.

Alpha (deg)

$C_L$



1. Report No. NASA CR-3200		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle Rotary Balance Data for a Typical Single-Engine General Aviation Design for an Angle-of-Attack Range of 8° to 90°. I - Low-Wing Model C.				5. Report Date October 1980	
				6. Performing Organization Code	
7. Author(s) William J. Mulcay Robert A. Rose				8. Performing Organization Report No.	
9. Performing Organization Name and Address Bihrl Applied Research, Inc. 400 Jericho Turnpike Jericho, New York 11753				10. Work Unit No. 505-10-13-06	
				11. Contract or Grant No. NAS1-14849, Task 35	
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Washington, DC 20546				13. Type of Report and Period Covered Contractor Report	
				14. Sponsoring Agency Code	
15. Supplementary Notes Langley Technical Monitor: James S. Bowman, Jr.  Topical report					
16. Abstract Aerodynamic characteristics obtained in a helical flow environment utilizing a rotary balance located in the Langley spin tunnel are presented in plotted form for a 1/6-scale, single-engine, low-wing, general aviation model (model C). The configurations tested included the basic airplane and control deflections, wing leading edge and fuselage modification devices, tail designs and airplane components. Data are presented without analysis for an angle-of-attack range of 8° to 90° and clockwise and counter-clockwise rotations covering an $\frac{\Omega b}{2V}$ range from 0 to .9.					
17. Key Words (Suggested by Author(s)) General Aviation Spinning Rotary Balance High angle-of-attack wind tunnel data				18. Distribution Statement  Unclassified - Unlimited  Subject Category 02	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 712	22. Price A99		